FLIGHT JUNE 24 1937

REGD AT THE G.P.O. AS A NEWSPAPER

R·A·F· DISPLAY

FLIGHT

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Vol. XXXI

ROLLS-ROYCE, AERO ENGINES FOR SPEED AND RELIABILITY

"Bristol"
BLENHEIM
BOMBER

FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

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The Coronation Display

ONCE again Hendon day approaches and the thoughts of everybody turn to the chances of fine weather for the great occasion. With few exceptions the R.A.F. Displays have been very fortunate, and mostly the sun has shone and everything has been glorious. May next Saturday be one of the best, and may the ladies' dresses which have survived Ascot make bright the enclosures at the aerodrome with no chrysalis-like mackintoshes and umbrellas to mar the butterfly effect!

One can hardly refrain from quoting Macaulay's line: "Unto the great Twin Brethren hold we this solemn feast." In this case the names of the great Twin Brethren are Coronation and Expansion. Both will be honoured on Saturday, for this will be the greatest and most significant of all the R.A.F. Displays ever held. In the first place, this is the Coronation Display, and our airman King will by his presence there make it the occasion of a Royal review and inspection of the Royal Air Force. It will rank in importance with the great naval review recently held in the Solent. Yet it will not interfere with the progress of the expansion of the Force, as a separate review would certainly do. At Hendon the King will see the best that his youngest fighting service can achieve, and yet everything done will be in the way of normal, useful work designed to increase the flying abilities and the fighting capacity of that Service.

The Coronation has brought to this country a vast multitude of visitors from the Dominions and Colonies, as well as from foreign countries. The majority of them are still in Great Britain, and without doubt they will flock to Hendon in their thousands. The fame of the flying marvels to be seen there each year has spread to every corner of the British Empire and of the world, and even the least air-minded person who loves a good show has longed, when reading the accounts of Hendon in the papers of Melbourne, Auckland, Capetown, Ottawa, Calcutta, and the other great cities of the Empire, to have a chance of witnessing such a wonderful spectacle with his or her own eyes. For many of them the chance has now come, and they will certainly take advantage of it. All of the great Dominions have Air Forces of their own, and their pilots fly right well. But money and time have been lacking to bring any Dominion Air Force up to the standard of the Royal Air Force in numbers and in equipment. Skilful flying has been seen at air displays in all the Dominions, and they will have set a standard by which those who have seen them will be able to appreciate the quality of the Hendon masterpiece.

Unprecedented Numbers

For the dwellers in the British Isles also this year's Display has a special significance because of the expansion of the Air Force which is now in progress and all the interest which it has aroused. Last year the work of expansion affected the character of the Display. Its effect was to curtail the number of aircraft congregated at Hendon, because more could not be spared from the work of bringing new squadrons to birth and of training new pilots and new aircraftmen. Incidentally, the quality of the show last year did not suffer through the small numbers of machines engaged, and the Display was one of unusual interest. This year, however, the position has changed. Expansion has now produced some of its effect; the Air Force is already much larger than it was last June, and now an unprecedented number of squadrons and machines can be sent to Hendon without doing any harm to the work of expansion.

Together with an increase in size has come an outstanding increase in the quality of the machines which are being supplied to the R.A.F. The public has read in the daily papers something about the remarkable performances of which the Blenheim, the Battle, the Wellesley, the Harrow, and the Whitley are capable, and they have seen some photographs of the types pub-

lished in the papers. Seeing a photograph is not the same as seeing a machine itself, and the Display will give a chance for people to see some at least of these excellent new aircraft in the air. The new types in the special park will show that the Air Ministry never rests content with any stage of excellence, but is always moving ahead towards something better. The mass formation flight of 250 machines will impress the spectators with the size to which the R.A.F. is now growing. Of course, twenty-five squadrons together are but a fraction of the Force's strength, but they will be a tremendous spectacle, and will send the assembled taxpayers home with the conviction that they really are getting something for their money, and that the Royal Air Force is a factor which potential enemies will hesitate to provoke.

Finally, we must not forget the foreign visitors. Probably the greatest number of the foreigners now in the country are Americans who came over for the Coronation and are staying to see the sights. It is always a good thing to let our American cousins see that the land of their ancestors can produce good designers and good pilots, but we do not look on Americans as either potential buyers or potential enemies. Of the Europeans who came to London for the Coronation most have probably gone home by now. But the Hendon Display always brings to London an influx of visitors of a special and important class. There are always potential buyers who will visit both the R.A.F. Display and the S.B.A.C. Display. Above all there always come men who wonder whether Britain can be a valuable friend or a formidable foe. We trust that Saturday will answer their queries. As Air Chief Marshal Sir Hugh Dowding says in the message printed below, the Displays have done much to enhance the reputation of the Air Force with foreign nations.

In short, everything combines to give promise of a really great day, and all that we hope for is that the sun will shine. Surely the proverbial King's weather will not fail King George VI.

THE DISPLAY

A Message to "Flight" Readers from Air Chief Marshal Sir Hugh Dowding, K.C.B., C.M.G., A.O.C.-in-C., Fighter Command

THE Royal Air Force Display must be regarded from three points of view: first, its appeal as a spectacle; secondly, its effect on the efficiency of the Royal Air Force; and, thirdly, its financial side.

The great British public loves a show, and it is but right and proper that the fighting Services for which they pay should let them see what they are getting for their money—always provided that training is not dislocated and that sensational effects, involving undue risks to the participants, are rigorously excluded.

Now, there is no doubt that the preparations for the Display absorb a very great deal of time and energy. In fact, it may almost be said that they are continuous throughout the year, for the accounting work on one Display is scarcely finished before discussions on the programme for the next Display begin. But it would be, I think, wrong to suppose that the preparations and practice for the Display have a deleterious effect on the training of the Air Force as a whole. In my opinion the contrary is the case. The careful and methodical preparations and training for spectacular events not only improves the standard of flying of the actual participants, but sets a standard for imitation by all, and helps to fix the dividing line between what can and cannot be safely attempted. To take a single instance, the general standard of formation flying has been immeasurably improved as the result of the earlier Pageants and Displays. Again, the concentration, maintenance, and subsequent dispersion of a large number of men and machines give valuable training to a number of Staff Officers, however little they may appreciate these benefits at the time. I also think that the series of Pageants and Displays which have been continuous since 1920 have done much to enhance the reputation of the Air Force with foreign nations.

The Display also affords a pleasant and informal link between the Service and the Royal Family, some members of which usually honour us by their presence.

Turning now to the financial side, the profits of the Display are devoted to various charitable objects. The lion's share, as is only right and proper, goes to the Royal Air Force Benevolent Fund, which was originally inaugurated to assist the victims of the Great War and their dependants, and which has since been extended to deal with post-War cases of distress, although War cases will always have priority of treatment so long as they exist.

This I take to be the least important object of the Display, because I confidently believe that even if not one penny were received by the Benevolent Fund from Display proceeds, the Air Force itself would contribute all that is necessary for this very worthy object; but it must nevertheless be pleasant for the public to know that their entrance money, besides affording them a unique and thrilling entertainment, also contributes to so worthy a cause.

H. C. T. Dowding.

The Outlook

A Running Commentary on Air Topics

A Great British Lead

IF this country may be said to have acted with lack of foresight in "shelving" the development of diesel engines, it is at any rate gratifying to be able to claim that Britain is leading the world in other directions. In the matter of superchaging we were quick to realise the advantages, compared with European nations, and our most recent engines with their two-speed blowers are as good as anything produced anywhere.

In one particular direction we are well ahead of all the rest of the world. The application of the Burt-McCallum sleeve-valve principle to aero engines has already reached a considerable degree of perfection in the Bristol sleeve valve engines, and examples have been tried experimentally in civil aircraft and are about to go into service on certain selected military types also.

Elsewhere in this issue will be found fuller particulars than hitherto disclosed concerning the Bristol two-row sleeve-valve engine, from which it will be seen that as a beginning 1,150 b.h.p. is being developed. It is fair to assume that, just as the rating of the different poppet-valve types has risen steadily, so will the rating of the sleeve valve, and 1,500 b.h.p. from a single unit does not seem to be an over-optimistic estimate for the ultimate take-off power of this engine.

Apart from the advantages of such great power from a single unit, the fact that it is being obtained from a sleeve-valve type brings about other advantages, largely from the operational and maintenance points of view. All of which is very promising for the near future.

Helping the Air Tourist

GOOD work has been done in the past by representatives of the Royal Aero Club of the United Kingdom on the *Fédération Aeronautique International* on behalf of air tourists. During the F.A.I. Conference which opened in London last Monday the R.Ae.C. will propose standardisation of the "Air Information" symbols used on flying maps, and also standardisation of map scales.

It might have been thought that the International Convention for Air Navigation, on which some thirty States have agreed to a uniform method of producing certain maps, would have covered this subject already, but unfortunately the I.C.A.N. agreement does not extend to maps above the 1/1,000,000 scale, which is too small.

The R.Ae.C. and A.A. will suggest, as a result of long practical experience, that there should be early standardisation of a series of maps on the 1/500,000 scale, and that this should be followed later by a 1/250,000 series.

It is quite obvious that such standardisation as the R.Ae.C. suggests would be highly desirable. Not only may the air tourist easily be misled by a change in map scale as he flies from one country into another, but the information concerning prohibited areas, air corridors, aerodromes, radio beacons and so forth, unless incorporated in standard form on the maps, is likely to be overlooked or misunderstood if the unfortunate air tourist has to carry about with him on a long tour the publications of all the different countries.

Russia Making History

THE fact that they failed to beat the existing world's record for distance in non-stop flight is relatively unimportant compared with the fact that the three Russians, Chekaloff, Baidoukoff and Beliakoff, have, for the first time in history, linked Soviet Russia with the United States by air via the North Pole. The machine was similar to that exhibited at the Paris Aero Show last November, an A.N.T.25 monoplane with a Russian engine of nearly 1,000 h.p., and the flight occupied 63 hours 17 minutes. As the distance covered was approximately 5,200 miles, the average speed works out at only 82 miles per hour or so. This need cause no great surprise, nor should it be taken as an indication that head winds were encountered. The A.N.T.25 is a very "clean" machine, but obviously not designed for high speed, its very large wing span and high aspect ratio having been chosen to keep down induced drag, which is important at relatively low speeds only.

It is the fashion in some quarters to belittle Russia's efforts in establishing herself as a designing and manufacturing country. The flight from Moscow to Oregon has at any rate shown that she possesses pilots and navigators capable of good navigation in difficult conditions, and that she can build aero engines which will go on running for long periods.

When the time comes for establishing an air route much shorter stages will be possible, and Russia will then have the advantage of a route which, if it has to contend with difficult weather conditions, will at any rate be free from European complications.

THIS WEEK: In this special Number of *Flight* a great deal of space is appropriately devoted to the work of the Royal Air Force, to its equipment, and to the machines, engines and accessories that will be seen at the R.A.F. Display at Hendon on Saturday and at the S.B.A.C. Display at Hatfield on Monday and Tuesday. For the benefit of new readers it should be pointed out that this issue is therefore not typical of a normal one; ordinarily, generous sections are devoted to Private and Club Flying, The Royal Air Force, Commercial Aviation and The Industry, together with feature articles covering a wide range of aeronautical subjects. *The Aircraft Engineer* supplement to *Flight*, usually appearing in the last issue of each month, was published this month in last week's issue, June 17th.

NEXT WEEK: Detailed and specially illustrated descriptions of the Royal Air Force Display and the Aircraft at the S.B.A.C. Show.

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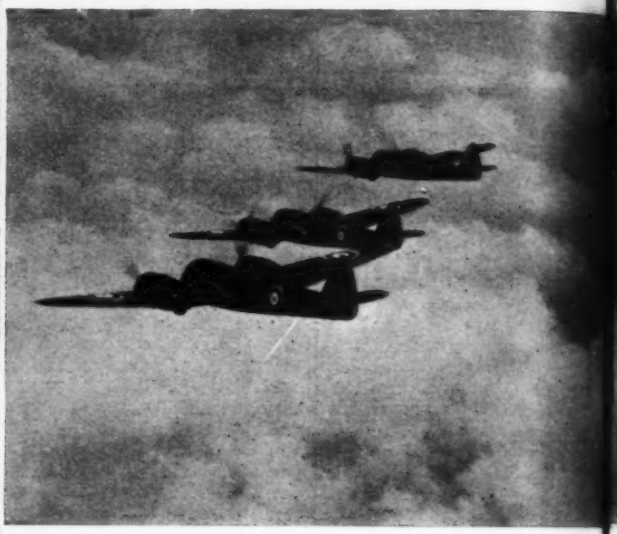


THE NEW AI

Organised for Peace War :

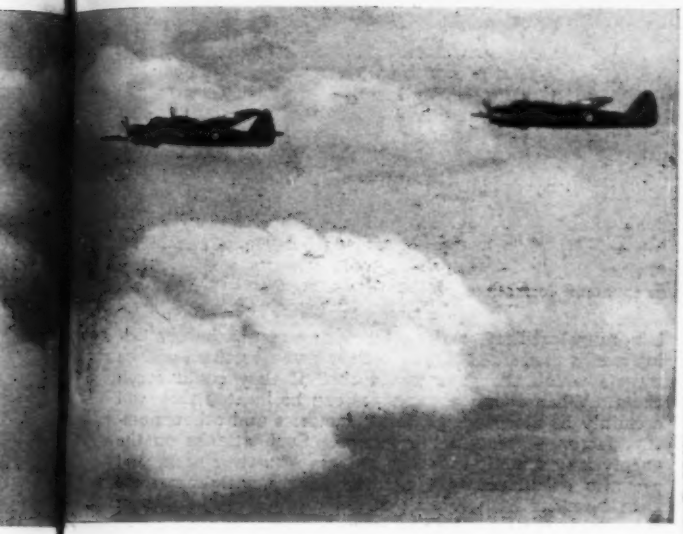
By MAJOR F. A. ROBE

THEY were good old days when the Royal Air Force in the United Kingdom consisted of (1) the Command, Air Defence of Great Britain, with its three subordinates, the Wessex Bombing Area, the Fighting Area, and No. 1 Air Defence Group; (2) the Coastal Area; and (3) the Inland Area. Certainly the country was in no condition to hold its own in a major air campaign, but then the Foreign Office had given its word of honour that no major war was to be expected. Despite a certain excitement not long ago in Northern Africa and the Mediterranean, the Foreign Office was proved correct. Nevertheless, that excitement proved mildly unsettling, and made our authorities turn their minds seriously to questions of reorganisation and re-equipment.

It was a delightfully simple matter to run the Fighting Area, for example, when the Air Officer Commanding had only to deal with a dozen squadrons, afterwards very cautiously increased to a baker's dozen. Certainly there were moments of strain and stress every summer during the air exercises, when continual watch and ward for four days and nights on end left the pilots and aircraftmen of the dozen squadrons in a state of exhaustion. It was also rather irritating when Mr. Fairey and Messrs. Boulton and Paul turned out Fox and Sidestrand bombers, and the Siskins had to do their hopeless best to intercept them. Yet again the equipment methods of the Air Ministry must have been very trying to the patience of an A.O.C. The adoption of some new and brilliant fighter type would be announced with a great flourish of trumpets, and all the fighter pilots would thrill with anticipation. Then the weary years would pass, hope deferred would make the fighter heart sick, and when at length the last squadron received that brilliant aeroplane it had already been outclassed by a still later product of the drawing offices. Still, it was all very good fun, and the life of the A.O.C., though sufficiently busy, was not unduly overcrowded.

Then as to the plums of the Service. There was only one Air Officer Commanding-in-Chief, and his command was Air Defence of Great Britain. There is something almost spellbinding about the initials C.-in-C. They recall the glorious day of Lord Wolseley and Lord Roberts. Then there were the Commands, which dealt direct with the Air Ministry. Cranwell and Halton were each of them a separate Command. The other Commands were given the title of Area—the Coastal Area and the Inland Area. Area is the term for the largest and most important organisation in the Air Force. Stepping down the scale we have Area, Group, Wing, below which come units such as a squadron, a depot, a park, or an independent flight. In the old organisation the term Area was used somewhat illogically, for all the Areas were not of equal dignity. The Coastal Area and the Inland Area were Commands which reported direct to the Air Ministry, but the Bombing Area and the Fighting Area were subordinate to Air Defence of Great Britain.

Groups did exist in the old Air Force. The Inland Area



A flight of Bristol Blenheims, 280 m.p.h. bombers.
(*Flight* photograph.)

AIR FORCE

eace War : A Flexible Framework

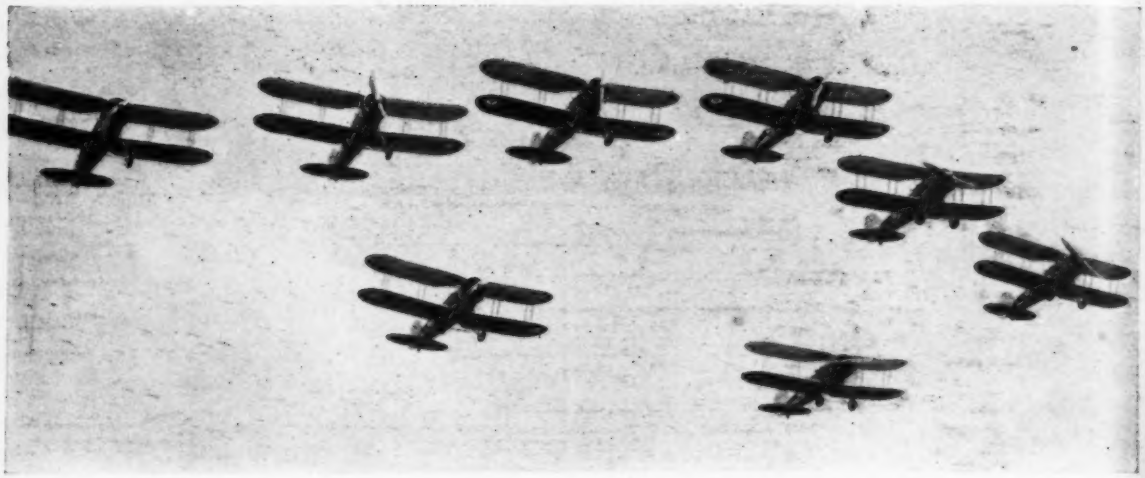
F. A. ROBERTSON, V.D.

included several Groups, which helped to simplify (or complicate, as you like it) administration, but they did their work quietly and loomed but little in the public eye. The Inland Area, in fact, much resembled the former Austro-Hungarian Empire, which Beaconsfield or some other politician of Victorian days described as "a ramshackle Empire." The Inland Area dealt with all the store depots of the R.A.F. and all the training schools other than those at Cranwell, Halton, and Lee-on-the-Solent. To this Area was also added the care of the army co-operation squadrons. It always seems a bit of a problem for the Air Ministry to deal with the army co-operation squadrons. They are certainly operational squadrons in that their work is connected with fighting, but it is ground fighting, not air fighting, with which they deal. The Inland Area was not much concerned with operations, but at the time it seemed less incongruous to place it in charge of these army co-operation squadrons than to hitch them on to either a bomber or a fighter organisation. This policy has since been reversed, as we shall see below. Of the Coastal Area all that need be said is that it was the descendant of the Royal Naval Air Service, and administered the coast defence squadrons, i.e., flying boat and torpedo bomber squadrons, and also the squadrons and flights of the Fleet Air Arm when ashore. It was in charge of flying training for the pilots of flying boats and deck-landing machines, and it ran the School of Naval Co-operation for naval observers at Lee-on-the-Solent, as well as a long navigation course at Calshot. Such, in brief, was the skeleton of the old R.A.F. in the United Kingdom.

Then came the expansion. Squadrons were to be multiplied until the first-line machine strength in the country rose to 1,750, and pilots and aircraftmen were to pour in by hundreds and thousands. Obviously, the old organisation could not deal with the new situation, and a fresh start had to be made. So Commands, Areas, and Groups were all thrown into the melting pot and remoulded nearer to the heart's desire. The result is the following organisation.

There are now four Commands, and at the head of each is an Air Officer Commanding-in-Chief. Four Cs.-in-C. instead of one! That naturally gratified the swelling ranks of Air Officers. Incidentally, it may be explained that the term Air Officer, which corresponds roughly to the naval term Flag Officer, means Air Commodores and all four grades of Marshal in the R.A.F. The four new Commands are the Bomber Command, the Fighter Command, the Coastal Command and the Training Command. The term Area has for the moment disappeared.

Before dealing with the sub-divisions of these four Commands it may be profitable to consider the new position. Undoubtedly the new position is more logical from the strategic point of view. Previously the bomber and the fighter organisations were linked together under Air Defence



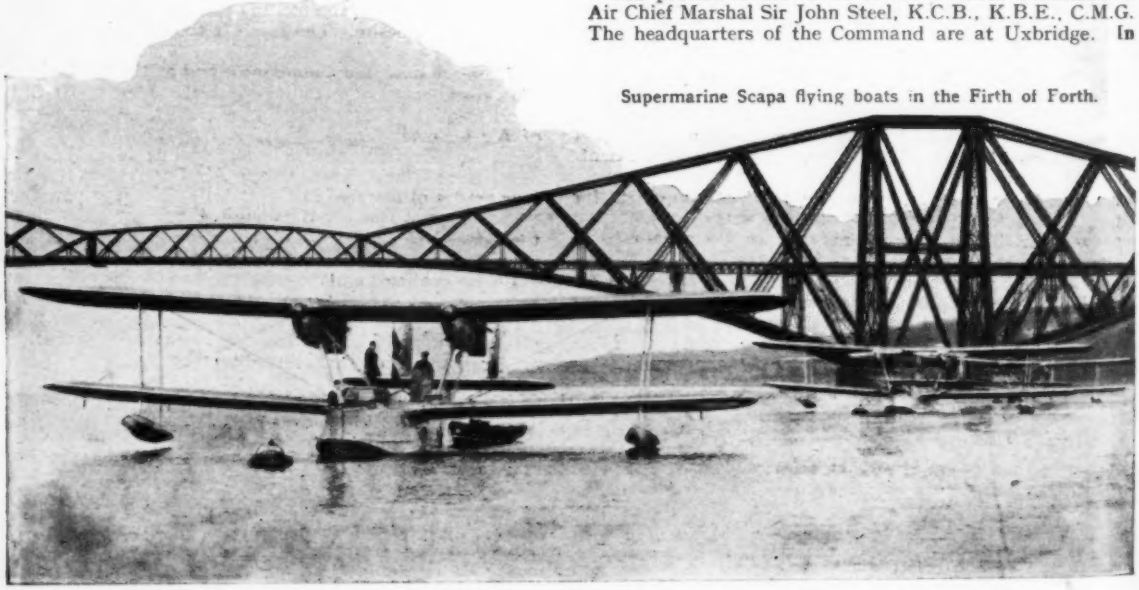
Gloster Gauntlet fighters in squadron formation.

of Great Britain. Doubtless the reason for that was found by invoking the old maxim, "Attack is the best form of defence." That maxim has not been abandoned, but the new fashion is to talk of active defence (i.e., using one's bombers to carry the war into the enemy's country) and passive defence, which means shooting down enemy raiders which cross the British coast line. Tactically those two sorts of operation are so very different that it is wise to keep them separate and to put each under the care of an A.O.C.-in-C.

The Bomber Command

Let it be emphasised that this new arrangement does not in any way imply that the bombers are now to be regarded as baby-killers any more than they were before. Attacks on civil populations are not part of the military doctrine, and it is the military doctrine which is taught at the R.A.F. Staff College at Andover. Such brutal attacks can only be ordered by a civil Government. If any lesson can be drawn from the deplorable civil war in Spain, it is that bombing of a civil population fails absolutely to bring about a military surrender. No! Bombers are essentially long-range artillery, and, so far as any non-barbarous belligerent is concerned the objectives given to them will be targets which the guns would shell if they could reach them. When enemy aerodromes can be located they will certainly be attacked. Aircraft factories and other munition factories are also fair game. Such attacks on the enemy may sometimes scotch the wasps in their nests, and are also calculated to make the enemy withdraw some light bombers from raiding in order to strengthen his air defence. If our bombers can force him to take such a step they will have notably relieved the pressure on our own passive defence. No part of a campaign requires more systematic and skilful direction than does bombing. Effort should be concentrated and not dissipated. The exigencies of the moment must be studied, and the bombers should be launched against whatever objective is at the moment most urgent. For instance, when a critical battle is in progress the bombers should give their full attention to cutting the enemy's lines of communication and so preventing reinforcements from reaching his battle line. In the intervals between crises they should attack his sources of munition production. Brain and common sense are required all through.

The present A.O.C.-in-C. of the Bomber Command is Air Chief Marshal Sir John Steel, K.C.B., K.B.E., C.M.G. The headquarters of the Command are at Uxbridge. In



Supermarine Scapa flying boats in the Firth of Forth.

this Command there are five Groups with headquarters as follows:—No. 1 at Abingdon, No. 2 at Andover, No. 3 at Mildenhall, No. 4 at Linton-upon-Ouse, and No. 6 (Auxiliary) Group with headquarters at 33-34, Tavistock Place, London, W.C.1.

The composition of these Groups is not yet definite and final, for new stations are gradually being got ready for occupation and new squadrons are coming into being week by week. Consequently moves are frequent, and transferences of squadrons and stations from Group to Group, and even from one Command to another, are not uncommon. It would, therefore, be of little use to give the present arrangements of squadrons in the Groups. Suffice it to say that No. 1 (Bomber) Group is under the command of Air Commodore Sydney Smith, lately returned from Singapore, and is composed of light and medium bomber squadrons. At the moment of writing it has fifteen regular squadrons, but will probably have to hand some of them over to other Groups before long.

No. 2 (Bomber) Group may be said, in a very general way, to be the successor of the old Wessex Bombing Area, excluding the heavy bomber squadrons. Its squadrons are equipped with light and medium-class bombers, and their numbers include two squadrons of the Auxiliary Air Force, namely, No. 602 (City of Glasgow) B.S. and No. 605 (County of Warwick) B.S. It also administers the Staff College at Andover, obviously as a mere matter of convenience, because Andover is the headquarters of the Group. The present A.O.C. is Air Commodore S. J. Goble, C.B.E., D.S.O., D.S.C., of the Royal Australian Air Force, who is now serving with the R.A.F. "on exchange." It is an admirable and wise arrangement which permits officers of the Home and Dominion Air Forces to gain practical experience with one of the sister Services. The inclusion of two Auxiliary squadrons in this Group should be noted.

No. 3 (Bomber) Group is essentially the heavy bomber organisation, and its A.O.C. is Air Vice-Marshal P. H. L. Playfair, C.B., C.V.O., M.C. No. 4 (Bomber) Group is in process of taking shape, and it was only the other day that Group Capt. A. T. Harris, O.B.E., A.F.C., was gazetted as its Air Officer Commanding.

The number 5 has so far been left blank in the list of Groups, and the next one to consider is No. 6 (Auxiliary) Group. In the old organisation of the R.A.F. all the squadrons of the Auxiliary Air Force and the cadre squadrons partly manned by the Special Reserve were kept together under No. 1 Air Defence Group. The name has been changed to No. 6 (Auxiliary) Group, but that is not the only change which has taken place. All the Special Reserve squadrons have been converted into Auxiliary Air Force squadrons, thus setting free a number of regular officers and airmen who were urgently needed elsewhere on account of the expansion scheme. Previously all the squadrons of the Group were bombers, mostly light bombers, but three of the Special Reserve units had heavy bombers.

Now the Auxiliary Air Force is much more varied. In all probability the heavy machines will be exchanged for light bombers, as it is not reasonable to expect unpaid part-time officers, who have to earn their living by working most days of the week in offices, to give up their sleep and spend some of their nights in flying. The Auxiliary Air Force, now approaching a roll of twenty squadrons, does not merely consist of bombers. It includes fighter squadrons and army co-operation squadrons. The five squadrons of two-seater fighters have been placed in No. 11

Gladiators are the best, and perhaps the last, biplane single-seater fighters to be issued to the R.A.F. (*Flight* photograph).

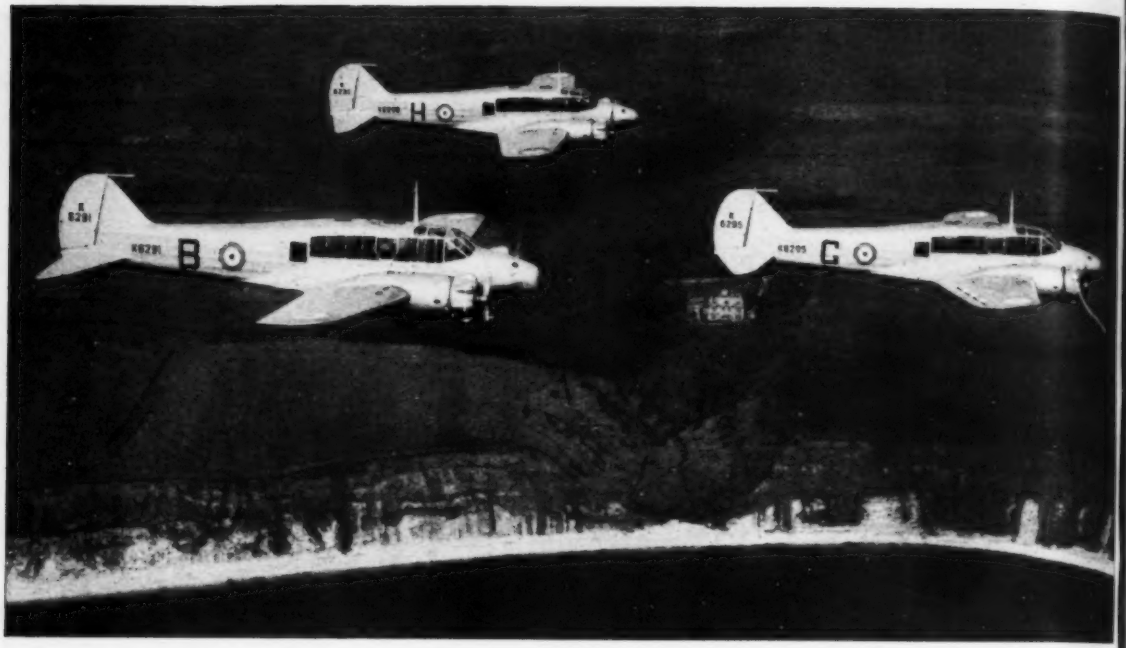
and No. 12 (Fighter) Groups, the four army co-operation squadrons are going into No. 22 (Army Co-operation) Group, and, as was mentioned above, the Glasgow and County of Warwick Squadrons are in No. 2 (Bomber) Group.

There seems a lack of system about this distribution of the A.A.F. squadrons. It may be accounted for in this way. When the non-regular units were first raised it was very naturally believed that special methods must be used in dealing with part-time volunteers who could not be subjected to the same discipline as the regulars. Therefore a special organisation was set up to deal with them. Later on the experiment was made of placing the cadre squadrons in a regular Area, and this proved quite successful. So now there is no hesitation in grouping the Auxiliaries wherever is most convenient. They are all enthusiasts, and they always respond to any demands made on them. The ordinary regular staff officer has been found to be quite reasonable in what he asks them to do. The supposed difficulties have not materialised.

The Fighter Command

The Fighter Command has its headquarters at Stanmore Manor, Hertfordshire, and its A.O.C.-in-C. is Air Chief Marshal Sir Hugh C. T. Dowding, K.C.B., C.M.G. His squadrons are divided into No. 11 (Fighter) Group with H.Q. at Uxbridge, No. 12 (Fighter) Group at Hucknall, No. 22 (Army Co-operation) Group at South Farnborough, and No. 30 (Balloon Barrage) Group with H.Q. at 33-34, Tavistock Place, London, W.C.1. For operations in peace and war the A.O.C.-in-C. also has under his command all the anti-aircraft artillery brigades and the searchlight battalions of the Territorial Army.

Nos. 11 and 12 (Fighter) Groups are normal, except that No. 11 includes the three Auxiliary fighter squadrons at Hendon, namely, Nos. 600, 601, and 604 F.S., while No. 12 Group has the two Auxiliary fighter squadrons in the North, No. 608 (North Riding) F.S. at Thornaby, Yorks, and No. 607 (County of Durham) F.S. at Usworth. In No. 22 Group we see once more the embarrassment caused



Avro Ansons are the aircraft of the general reconnaissance squadrons which patrol the waters round the coast of Britain.

to the Air Ministry by the Army Co-operation Squadrons. Formerly they were given to the Inland Area; now they are given to the Fighter Command, although their work has nothing to do with air fighting. Still, the Air Ministry must put them somewhere.

The Balloon Barrage Group is organised on the same footing as the Auxiliary Air Force, being manned by non-regular volunteers. Its A.O.C. is Air Commodore J. G. Hearson, C.B., C.B.E., D.S.O., who has retired from the R.A.F. As he once commanded No. 1 Air Defence Group he has experience of dealing with part-time airmen. He has a serving Group Captain as his senior air staff officer.

The Observer Corps is also part of the Fighter Command. It is composed of civilians enrolled as special constables, and its duties have often been described in *Flight*. Its commandant is another retired officer, Air Commodore A. D. Warrington-Morris, C.M.G., O.B.E. Thus it may be seen that, for operations at least, all the elements of the air defence of the country are congregated in the hands of the A.O.C.-in-C., Fighter Command.

Other Commands

Air Marshal P. B. Joubert de la Ferté, C.B., C.M.G., D.S.O., is the A.O.C.-in-C. of the Coastal Command. It is not very different from the old Coastal Area, except that it is divided into No. 16 (Reconnaissance) Group, whose A.O.C. is Air Vice-Marshal H. M. Cave-Browne-Cave, C.B., D.S.O., D.F.C., and No. 17 (Training) Group under Air Commodore C. D. Breese, C.B., A.F.C. The headquarters of the Command and of both Groups are at Lee-on-the-Solent. The Reconnaissance Group deals with the flying boat squadrons and the general reconnaissance squadrons (which latter fly Anson landplanes), while the Training Group administers the School of Naval Co-operation and most of the units which train for marine air work. The establishment at Felixstowe is under the Coastal Command, but Leuchars, where pilots from the Navy and Army are taught to fly, is no longer under Coastal administration, but has become No. 1 Flying Training School and forms part of No. 23 (Training) Group in the Training Command.

The Training Command has its headquarters at Market Drayton, Shropshire, and its A.O.C.-in-C. is Air Marshal Sir Charles S. Burnett, K.C.B., C.B.E., D.S.O. It is at the moment probably the hardest worked of all the Commands, for it has to take charge of all the embryo pilots and aircraftmen who are now thronging into the Air Force by hundreds and thousands. Its four Groups are: No. 23 (Training) Group, No. 24 (Training) Group, the Armament Group, and Cranwell. No. 23 administers the eleven flying training schools, the Central Flying School where flying instructors are trained in the art of teaching pupils to fly, and the School of Air Navigation at Manston. Its H.Q. are at Grantham. No. 24 (Training) Group administers the R.A.E. at Farnborough, Martlesham, Cardington, Halton, Henlow, the School of Technical Training at Manston, the two balloon training units, all the equipment depots, and such units as the Central Band. Its H.Q. are at Halton. Halton, with its large school for aircraft apprentices, was formerly an independent Command. Now it is not even a Group, but has become a mere station in No. 24 (Training) Group. And why not?

The Armament Group administers the five armament training camps, the Air Armament School at Eastchurch, and the Air Observers' School at North Coates Fitties. Cranwell, once an independent Command, is now more appropriately a Group in the Training Command.

This brief description gives the framework of the new R.A.F. There are still some inconsistencies in it, but the trend is steadily towards orderly and logical arrangement. It is a flexible framework, permitting of easy expansion or contraction as circumstances demand. And if expansion continues until any Command contains more Groups than it can efficiently manage, it will still be possible to interpose an Area and so relieve the pressure. Expansion seems likely to continue even after the present programme has been completed. The prospect is grievous for the taxpayer, but it is always an economy to avoid a war, and nothing is so expensive as defeat in war. A weak Britain is a temptation to aggressive Powers, and the mere threat of air raids is enough to spoil the quiet sleep of the worthy citizen. But even ill-disposed nations will hesitate to play the good old game of twisting the lion's tail when the claws of the king of beasts are sharp. A strong R.A.F., together with a strong Navy, are the citizen's best antidote to insomnia.

JOINING the R.A.F.

Various Methods of Entry Into the Air Force : Qualifications Needed : Ages and Classes for Entry of Boys.

WHEN, after the War, the R.A.F. was reorganised on a peace-time basis, its strength was fixed at thirty squadrons—in this country and overseas. Each year since that time has seen added responsibilities at home and abroad heaped on to the "Junior" Service, and when the present expansion programme has been completed the strength of the R.A.F. at home and overseas will be 180 squadrons. During the last year personnel has been greatly increased in every branch of the Service, and daily more recruits are received by one or other of the several methods of entry.

Permanent commissions obtained by entry through the R.A.F. College, Cranwell, by entry from a University or by direct selection from the ranks have been dealt with from time to time in *Flight*; so also have Short Service commissions by selection from those candidates who are able to show the required educational standard.

Aero engine fitters in the making. Practical instruction in radial engines given to aircraft apprentices.

Normal entry to the R.A.F. is divided into two main sections, one for men and one for boys. Men are eligible unless they are married and under 26 years old, paid Naval or Army Reservists, or in receipt of a disability pension. The trades which can be followed, together with rates of pay, are contained in Form 434, obtainable from the Air Ministry, and these are roughly :—

TECHNICAL.

Group I.—Fitter, grades I and II; fitter (aero engine); fitter (armourer); fitter (torpedo); instrument maker; machine tool setter and operator; metal worker; wireless operator mechanic.

Group II.—Armoured car crew; armourer; balloon operator; carpenter; flight mechanic; flight rigger; photographer; wireless operator.

Group III.—Cook and butcher; fabric worker; hydrogen worker (2nd class); motor boat crew; storekeeper.

ADMINISTRATIVE.

Group IV.—Clerk (general duties); clerk (accounting).

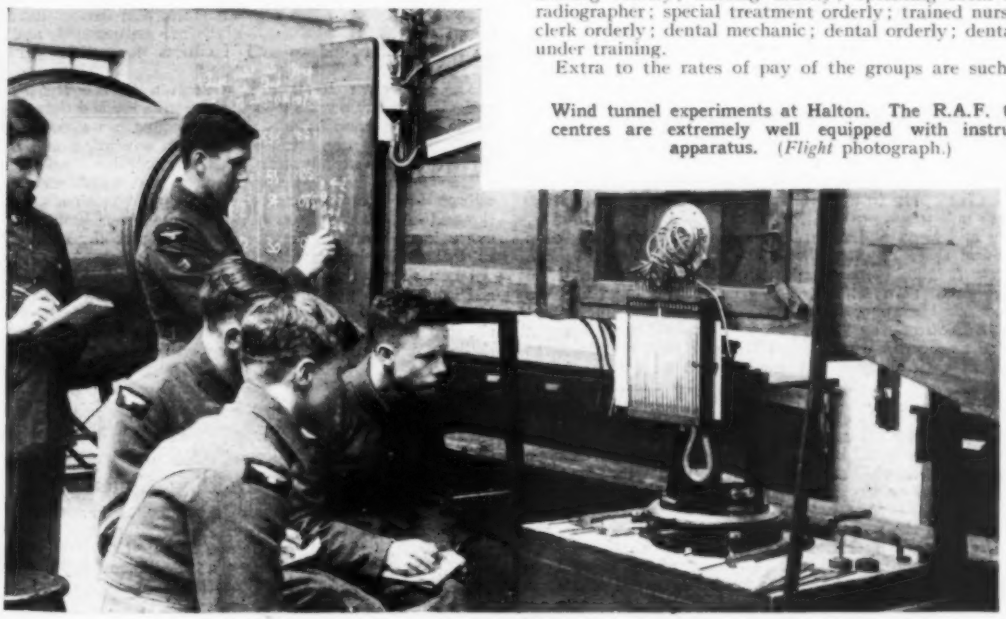
NON-TECHNICAL.

Group V.—Aircrafthand (general duties); aircrafthand (under training for technical trades); driver (petrol); mate; musician; torpedoman.

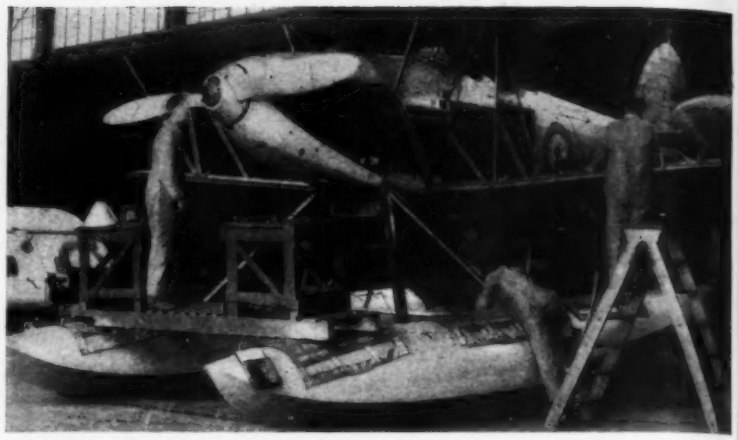
MEDICAL AND DENTAL.

Group M.—Dispenser; laboratory assistant; masseur; medical orderly; medical orderly under training; mental nursing orderly; nursing orderly; operating room assistant; radiographer; special treatment orderly; trained nurse; dental clerk orderly; dental mechanic; dental orderly; dental orderly under training.

Extra to the rates of pay of the groups are such sums as



Wind tunnel experiments at Halton. The R.A.F. training centres are extremely well equipped with instructional apparatus. (*Flight* photograph.)



Fitters and riggers at work on a Hawker Osprey.
(R.A.F. official photograph, Crown copyright.)

flying bounty, flying instructional allowance, and good conduct money. A limited number of airmen are selected to complete 24 years' service and become qualified for a pension.

On application for enlistment a form (No. 429) dealing with age, experience, physical condition, previous service, etc., is sent; this must be completed and returned. If it is satisfactory, a railway ticket is sent to the applicant, who then appears at the Recruiting Office, Victory House, Kingsway, and is interviewed. A medical examination is carried out and a short educational or trade examination is taken which varies according to trade and standing. On the satisfactory completion of these the recruit is asked to decide for certain that he wishes to join the R.A.F. and is then sworn in. After signing the necessary document the recruit is taken to the R.A.F. station at Uxbridge before being stationed permanently and receiving uniform. The principal technical training schools for men are at Manston, Henlow and Cranwell.

Regulations governing the entry of boys into the Air Force are more complicated than for men, and entry comes under three headings: (1) Aircraft Apprentices, (2) Boy Entrants, (3) Apprentice Clerks. The methods and ages of entry differ and no change-over can be made after acceptance. In normal times the majority of the airmen in the Service come from the two schools for aircraft apprentices at Halton and Cranwell. Instrument makers and wireless operator mechanics are trained at Cranwell; fitters, and fitters (armourer) at Halton.

Entry for aircraft apprentices takes place by competitive examination in January and August each year, and candidates must be between the ages of 15 and 17 years on the first day of their month of entry. If a candidate has passed an approved school certificate in specified subjects he may be exempt from the examination. Application for entry can only be made through an approved nominating authority (i.e., through the school to the education committee or to the local juvenile employment bureau).

Technical Training

After entry as an aircraft apprentice three years' technical training in a skilled trade is received, and the apprentice continues to complete twelve years' regular service from the age of 18. At the end of this period an apprentice may (a) enlist in the Reserve for four years and receive a gratuity of £100; (b) be re-engaged for a further twelve years if selected for one of the limited number of re-engagement vacancies. At the end of his three years' training he may be granted a cadetship leading to a permanent commission; alternatively he may be selected during his service for training as airman pilot (which also gives him a prospect of selection for a permanent commission).

All details regarding entry and training are contained in A.M. pamphlet 15.

For the second method of entry candidates may either be invited to enlist in the Service as boy entrants, if no vacancy is offered following the examination for entry as aircraft apprentices, or apply to an approved authority for nomination for direct enlistment. Entries take place in February, September and May, and candidates must be between 15 years 9 months and 17 years 3 months on the first day of their month of entry. A good general education is necessary, and on acceptance 12 to 16 months' training as an armourer, wireless operator or photographer is received, followed by nine years' regular service from the age of 18. Airmen having entered the Service under this section may be selected for training as airman pilots with chances of being selected for commissioned rank. Re-engagement to complete 24 years' service is also possible.

The third and last method of entry is as apprentice clerk. An approved first school certificate or the attainment of an educational standard which is approximately equivalent is needed before entry, which takes place quarterly in January, April, July and October. The age limits in this case are 15 years 6 months and 17 years 3 months. Applications must be made to Victory House on A.M. Form 1334, and A.M. Pamphlet 9 deals thoroughly with entry and training in this section. The initial service is for twelve years from the age of 18 with a possible further twelve or enlistment in the Reserve following it. Airmen entered as apprentice clerks are eligible for selection as pilots.

The opportunities for experience and training in many trades and the chances of seeing the overseas stations are exceptional. Any man after enlistment may attend free educational and training classes at his aerodrome, and while knowledge of a civilian trade is not essential it will be an advantage and aid towards promotion. There are always openings for skilled men, but many of these are filled by aircrafthands who have been selected for special training after a period of service.

Food and quarters are of very high standard in the Air Force, and if a man is stationed in Iraq, Palestine, Egypt, Singapore or China, or is selected for service on an aircraft carrier, he may now expect the same comforts as at the home aerodromes. Uniform is issued free and a quarterly clothes allowance is made. Furnished married quarters are also available at many stations at home and overseas for men with 12 years' service.

Every aerodrome has a gymnasium, and several have swimming baths. Sports of all kinds are encouraged, and in the quarters billiard tables and facilities for other games are supplied.

The Volunteer Reserve is a section of the R.A.F. which appeals to many people who wish to give limited time to service flying training and have a civilian occupation also. Forms for application for membership deal with education and training, and a medical examination and interview by a selection committee follow before acceptance. Five years' service is required, and the allowance depends upon the time given. At the end of the completed period a gratuity is granted. As in every branch of the Service, the applicant must be a British subject of British parents.

Upon completing a period of service with the R.A.F. every aid is given to a man in finding a civilian occupation, and it has been found that usually this is not difficult by reason of the demand for men with extensive flying experience or having skilled training in fitting, rigging, wireless operation and other trades.

Aircraft Workers' Pensions

THE stability and permanence attained by the British aircraft industry is strikingly illustrated by pension scheme announcements recently made. The first is an announcement to staff and works employees of Hawker Aircraft, Ltd., by its chairman, Mr. T. O. M. Sopwith, and the second an identical announcement to the employees of its associated company, the Gloster Aircraft Co., by Mr. F. S. Spriggs, the chairman.

Both schemes embody all the advances which have been made in developing group benefit plans by actuarial science in recent years. The schemes are on a contributory basis, and have been placed for administration with the Eagle Star Insurance, Co., Ltd.

Lighter Landing Lights

REFINEMENT of certain components has allowed a reduction in the weight of the landing light produced by Mechanism, Ltd., of 6a, George Street, Croydon, from 4¾ lb. to 3¾ lb. The lamp is now a bi-filament type, and incorporates spinnings instead of castings.

THE S.B.A.C. DISPLAY

A Splendid Aero Show at Hatfield Next Monday and Tuesday : Twenty Aircraft firms to be Represented : Latest Aero Engines on View : Comprehensive Exhibit of Accessories and Equipment

FOR the sixth year in succession the Society of British Aircraft Constructors is staging, on the days following the R.A.F. Display, a combined aero exhibition and flying display. As in previous years, the S.B.A.C. Display is not open to the general public, admission being by invitation only. Representatives from nearly all the European countries, and many extra-European, have been invited, and large numbers have accepted so that again this year the S.B.A.C. Display can be counted on to be at least as great a success as have been the previous shows

Once more the venue for the S.B.A.C. Display will be De Havilland's aerodrome at Hatfield, where one of the large hangars has been set aside for the "static" part of the exhibition. In this will be housed the aero engines, materials, accessories and equipment which the different members of the S.B.A.C. have elected to exhibit and/or demonstrate. The static show is reviewed on pages 642-645 (engines) and 648-656 (components).

A welcome innovation this year is the decision to make the S.B.A.C. Display a two-day affair. In previous years the many visitors have had insufficient time to see everything they wanted, and the proposed arrangement of keeping the exhibition open on the Tuesday as well will certainly be welcomed by a large proportion.

The programme drawn up for the S.B.A.C. Display provides for a "static" day on the Monday, while the Tuesday will be largely devoted to flying displays, passenger flights and so forth, for those visitors who are specially interested in this side of the show. Others can, of course, spend Tuesday also in the "static" exhibition if they so wish, thus having an opportunity of a much more thorough inspection of the exhibits than was possible when the Display was confined to one day.

Welcoming the Guests

On Monday, June 28, the official luncheon will be held in a marquee on the aerodrome, at which Mr. F. Handley Page, who is the present chairman of the S.B.A.C., will welcome the many hundreds of guests who have been invited and who will represent approximately 50 different countries.

The aerodrome at Hatfield will be open from 10 a.m. onwards, and arrangements have been made for coaches to meet suitable trains at Hatfield Station for those guests who wish to make the journey by rail from King's Cross station. The best train for the purpose leaves King's Cross at 9.30 a.m. The buses of route No. 340 from Hatfield also pass the aerodrome entrance, and from Central London Green Line coaches of routes K1 and K2 can be boarded at Hyde Park Corner or Marble Arch. Visitors who proceed to Hatfield in their private cars will find the shortest and quickest route to be along Finchley Road, Hendon Way, Watford Way, and the Barnet Bypass; the latter joins the St. Albans-Hatfield road a couple of hundred yards before the aerodrome entrance is reached.

No fewer than twenty aircraft firms have signified their intention of having machines on view at Hatfield. Between them they hope to show about 40 different types, ranging from tiny single-seater light planes to heavy twin-engined bombers and four-engined commercial aircraft. At the time of going to press with this issue of *Flight* some of the firms had not finally decided on their exhibits, but it is believed that in the main the following forecast of what there will be to see at Hatfield is correct.

THE AIRCRAFT

Aeronca: The Aeronautical Corporation of Great Britain expects to show two Aeronca monoplanes, both with the 36/38 h.p. J.A.P. engine. One will be the touring monoplane and the other the Aeronca trainer.

Airspeed: The Oxford Service Training machine to be shown by Airspeed, Ltd., will be of particular interest in that at Hatfield it will make its first public appearance. The machine is fitted with two Siddeley Cheetah X engines of 350 b.h.p. each, and is designed for training R.A.F. Service personnel in a modern twin-engined machine. Models of other Airspeed types will be shown in the "static" exhibition.

Armstrong Whitworth: At past S.B.A.C. Displays Sir W. G. Armstrong Whitworth Aircraft, Ltd., have been represented mainly by small types of Service aircraft. This year the firm will go to the other end of the scale by showing the Whitley heavy bomber fitted with two Siddeley Tiger engines. Large numbers of Whitleys have been ordered for the R.A.F., and doubtless many of the Hatfield visitors will be glad of an opportunity to inspect at close quarters the machine which they will have seen taking part in some of the evolutions at the R.A.F. Display at Hendon the previous Saturday.

Hafner: The A.R.III Construction Co. had intended to show the Hafner Gyroplane with 90 h.p. Pobjoy engine, but the machine met with a slight mishap at Farnborough recently, and at the moment it is doubtful if the necessary repairs can be carried out in time. The machine is extremely interesting with its short take-off run, steep climb and extreme manœuvrability, so that it is very much to be hoped that it may be found possible to get it finished by June 29.

Blackburn: Owing to the fact that it has barely finished its extensive flying trials there was some doubt about the Blackburn dive bomber being available for the Hatfield Display. Just as we go to Press, however, we are informed that the machine will definitely be presented. It has been designed to an extremely difficult specification and will be examined with interest. The other machine to be shown by Blackburn Aircraft, Ltd., will be a Shark with Tiger engine.

Bristol: There will be much to interest Hatfield visitors in the machines to be shown by the Bristol Aeroplane Co., Ltd. The Blenheim medium bomber is generally agreed to be probably the fastest machine of its class at 280 m.p.h. when fitted with two Bristol Mercury engines. Consequently it will certainly come in for very careful examination by discriminating visitors.

In addition to the Blenheim, the Bristol company will show other Bristol products in aeroplanes not of Bristol design. For instance, one of the new Rotol constant-speed airscrews will be shown on a Bristol Mercury engine in a Hawker Hart biplane, and the Bristol Perseus sleeve-valve engine will be shown in a Hawker dive bomber.

C.W.: C.W. Aircraft, Ltd., of Slough, will be represented by the new small all-metal Cygnet Minor cabin light monoplane fitted with Cirrus Minor engine. This machine, it will be recollected, is a side-by-side two-seater of metal stressed skin construction. It is one of the smallest aeroplanes ever to be

De Havilland: As the S.B.A.C. Display is being held at Hatfield, it is natural enough that the De Havilland Aircraft Co., Ltd., will be represented by a greater number of aircraft than any other firm. Already well known are the following D.H. types which will be on view: D.H.86B, Dragon Rapide, Dragonfly, Hornet Moth, and Tiger Moth. In addition, however, visitors will have an opportunity to inspect the new D.H.91 or Albatross, which is the fastest British commercial aeroplane on the market to-day, and two of which have been ordered by the British Air Ministry for experimental flights over the Atlantic. The commercial model has a very comfortable passenger accommodation, whereas in the long-range types most of the cabin space is, of course, occupied by fuel tanks. Of further interest is the fitting of four of the new De Havilland Gipsy Twelve engines, which are of the twelve-cylinder inverted air-cooled type. The very latest

De Havilland type, the Don Trainer, will also be on view. This is fitted with the Gipsyking engine, which is the Service version of the Gipsy Twelve. This machine will make its first appearance at the S.B.A.C. Display.

Fairey: Of the four types to be shown by the Fairey Aviation Co., Ltd., three are military and one a very civil type, viz., the tiny Tipsy light monoplane with Douglas Sprite engine.

The other three are a Fairey Swordfish with Bristol Pegasus engine, a Battle with Rolls-Royce Merlin, and a P.4/34, also with the Merlin engine. The Swordfish has been produced in considerable numbers and has seen a great deal of service. It is a torpedo spotter reconnaissance biplane. The Battle is classed as a medium bomber, and is one of the types scheduled for mass production under the so-called "Shadow Scheme." The P.4/34 is very similar to the Battle in general appearance, but is a good deal smaller. As it has the same engine it goes almost without saying that its performance is even better than that of the Battle.

Gloster: A very excellent opportunity for a comparison between monoplane and biplane single-seater fighters will be provided by the exhibits of the Gloster Aircraft Co., Ltd., who will have at Hatfield the Gladiator with Bristol Mercury and the brand-new monoplane with the same engine. That the monoplane type scores in the matter of pure speed may be granted, but in manœuvrability the biplane is likely to prove superior. It would be extremely interesting to see the two types demonstrated simultaneously, but this may not be found practicable.

The Gladiator is already in service with the R.A.F., but the monoplane will be seen for the first time in the New Aircraft Park at the Hendon Display on Saturday.

Handley Page: The first new type to go into quantity production and to be delivered in considerable numbers to squadrons of the R.A.F. was the Harrow heavy bomber designed and built by Handley Page, Ltd., who for several months could claim the distinction of being the only firm with large orders for heavy aircraft up to or even slightly ahead of schedule in the matter of deliveries. The machine is a high-wing monoplane with non-retractable undercarriage and two Bristol Pegasus engines.

Probably Handley Page, Ltd., will also show the prototype H.P.53 or Hampden, which is a medium bomber mid-wing monoplane, also with two Bristol Pegasus engines. Its production in quantities will follow that of the Harrow.

Hawker: Hawker Aircraft, Ltd., will, for the first time in the history of the firm on such an occasion, be represented by two military monoplanes, the P.4/34 which is classed as a light bomber but which has been built with sufficient load factors to carry the military load of a medium bomber, and the Hurricane, a single-seater fighter. Both are fitted with the Rolls-Royce Merlin engine and both are of metal construction, although not entirely of stressed skin construction. Hawkers have evolved a very strong form of wing fabric attachment which in the severe tests carried out has shown no tendency to give trouble, even at the very great speeds attained by these machines.

Heston: Good performance coupled with operational economy and great comfort for the passengers are the outstanding features of the Phœnix monoplane which will be shown by the Heston Aircraft Co., Ltd. The machine carries pilot and four passengers at a cruising speed of 125-130 m.p.h. As the engine is a De Havilland Gipsy Six of but 200 b.h.p. the machine is very economical for charter and feeder line work.

Percival: High performance has characterised all the light aeroplanes produced by Capt. E. W. Percival, and the three machines to be shown at Hatfield by the Percival Aircraft Co., Ltd., are representative of the range which the firm has to offer. The machines will be a Vega Gull, a Gull Six, and a Mew Gull, all three fitted with the 200 h.p. De Havilland Gipsy Six engine. The Vega Gull carries pilot and three passengers at a cruising speed of 150 m.p.h. The Gull Six is a slightly older model, but has its own appeal, nevertheless. The Mew Gull is a very small and very fast single-seater with a cruising speed of something like 220 m.p.h. In spite of its small size and heavy wing loading, the Martlesham pilots reported very favourably on the handling qualities of this machine (see *Flight* of May 27, 1937).

Miles: Phillips and Powis will show three monoplane types of Miles design: the Magister, which is a service training type with Gipsy Major engine; the new Miles two-seater fighter trainer with Rolls-Royce Kestrel engine, and the Miles Whitney Straight cabin two-seater with 130 h.p. Gipsy Major engine. Particular interest will attach to the Rolls-Royce engined trainer, as this is the first machine of such high power to be designed by Mr. F. G. Miles and produced by Phillips and Powis.

Avro: A. V. Roe & Co., Ltd., will be represented by a single military machine, the Avro Anson (2 Siddeley Cheetah IXs of 310/350 b.h.p.) general reconnaissance type. This machine has been built in very large numbers and is used extensively by the British R.A.F.

An Empire Boat?

Short: The famous firm of Short Brothers, Ltd., will be showing one of the Short Scion Senior monoplanes fitted with four Pobjoy Niagara engines of 90 h.p. each. The machine is an air liner in miniature, and is particularly suitable for work on feeder lines on which forced landings must be avoided, the splitting up of the power into four units endowing the machine with the reliability and safety one associates with large four-engined air liners. In addition to the Scion Senior, one of the Short Empire flying boats will probably fly over in the course of the Tuesday's proceedings.

Supermarine: As most of the products of the Supermarine Aviation Works (Vickers), Ltd., are marine aircraft, with the exception of the Spitfire single-seater fighter, Supermarines will be represented at Hatfield by a single type, the Supermarine Walrus naval reconnaissance and coastal patrol biplane. This machine is an amphibian biplane flying boat with a Bristol Pegasus engine driving a "pusher" airscrew. The machine is used for deck landing, and is equipped for catapult launching.

Vickers: Two very different types of military aircraft will be shown by Vickers (Aviation), Ltd. One is the Wellesley long-range medium bomber with Bristol Pegasus, and the other the tiny Venom single-seater fighter with Bristol Aquila sleeve-valve engine. The Wellesley is of geodetic construction, which gives low structure weight with wings of high aspect ratio, and is, therefore, particularly suitable for long-range aircraft.

Westland: The machine to be shown by Westland Aircraft, Ltd., is the Lysander army co-operation monoplane with Bristol Mercury engine. In this machine particularly clever use has been made of automatic leading edge slots coupled to trailing edge slotted flaps, which do not come into operation until a certain tail-down attitude has been reached by the machine.

An Airco Change

PREVIOUSLY sales manager of Airco, Ltd., Mr. S. J. Gilbert has now been appointed civilian adjutant at the Catfoss Royal Air Force Station.

The Exactor Control

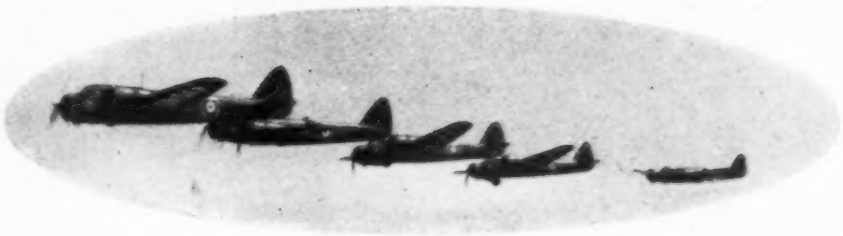
IN last week's issue there appeared a description of the new "Exactor" mechanical remote control, and in this connection it should be remarked that the address of the makers, the Exactor Control Co., is Exactor Works, Mount Pleasant, Alperton, Middlesex.

The Two-seater Tipsy

WITH the formation of the Tipsy Aircraft Co., Ltd., the English production of that interesting little two-seater training or touring version of the Tipsy monoplane (described in the issue of May 20) is brought a good deal nearer than we thought when the machine was first demonstrated over here. Shops are being taken over and extended at Hanworth so that the work can be started almost at once, and the company has the backing, as far as modifications and stress calculations are concerned, of the Fairey Company. The machine will, of course, have flaps, and the first machines, at least, are likely to be fitted with the Walter Mikron four-in-line. The single-seater will be built, as before, by Aero Engines, Ltd., of Bristol. The directors of the new company are Major J. E. D. Shaw (chairman), and Messrs. Leslie Irvin, Gilbert Miller, Brian Allen and George Birkett, the last two being joint managing directors.

Quieter Airscrew Testing

RECENTLY, it will be recalled, *Flight* described a new soundproof airscrew test tunnel erected at the Armstrong Siddeley works at Baginton, near Coventry. It should be made clear that this was designed by the Burgess Products Co., Ltd., in collaboration with Armstrong Siddeley Motors, Ltd.



UP in the BLENHEIM

A Civilian Pilot's Impressions as a Passenger in Our Fastest Bomber : Simplified Docility : Its Transport Ancestry.

By H. A. TAYLOR

UNTIL a matter of a year ago it was customary for the all-knowing ones, both inside and outside the aircraft industry, to point to America as the country where real aircraft development, in design, production and performance, was to be found. On the face of the matter such an implied accusation would then have been true enough, since progress usually occurs spasmodically and the American industry had simply received the necessary financial encouragement a year or two before ours.

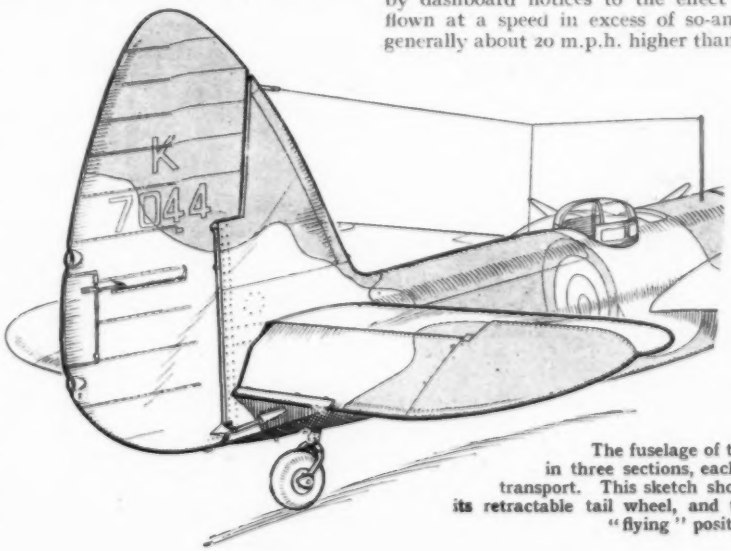
The fact that we can better the performance in the same conditions is now being adequately proved. As far as the general public is concerned, the most notable result of modern design and production is the Short Empire boat, but now that details of some of the more modern military machines are being released they are learning something of what can be done when the demand—and the wherewithal—is there.

For many reasons the Bristol Blenheim may be taken as the most representative example of the modern trend and is all the more interesting because it was directly developed from a normal civil type—the 142, or *Britain First*. A third machine on similar lines, the 143, has been designed purely for transport work, but has inevitably been put on one side while the Bristol organisation got down to rapid production of the more urgently required Blenheims.

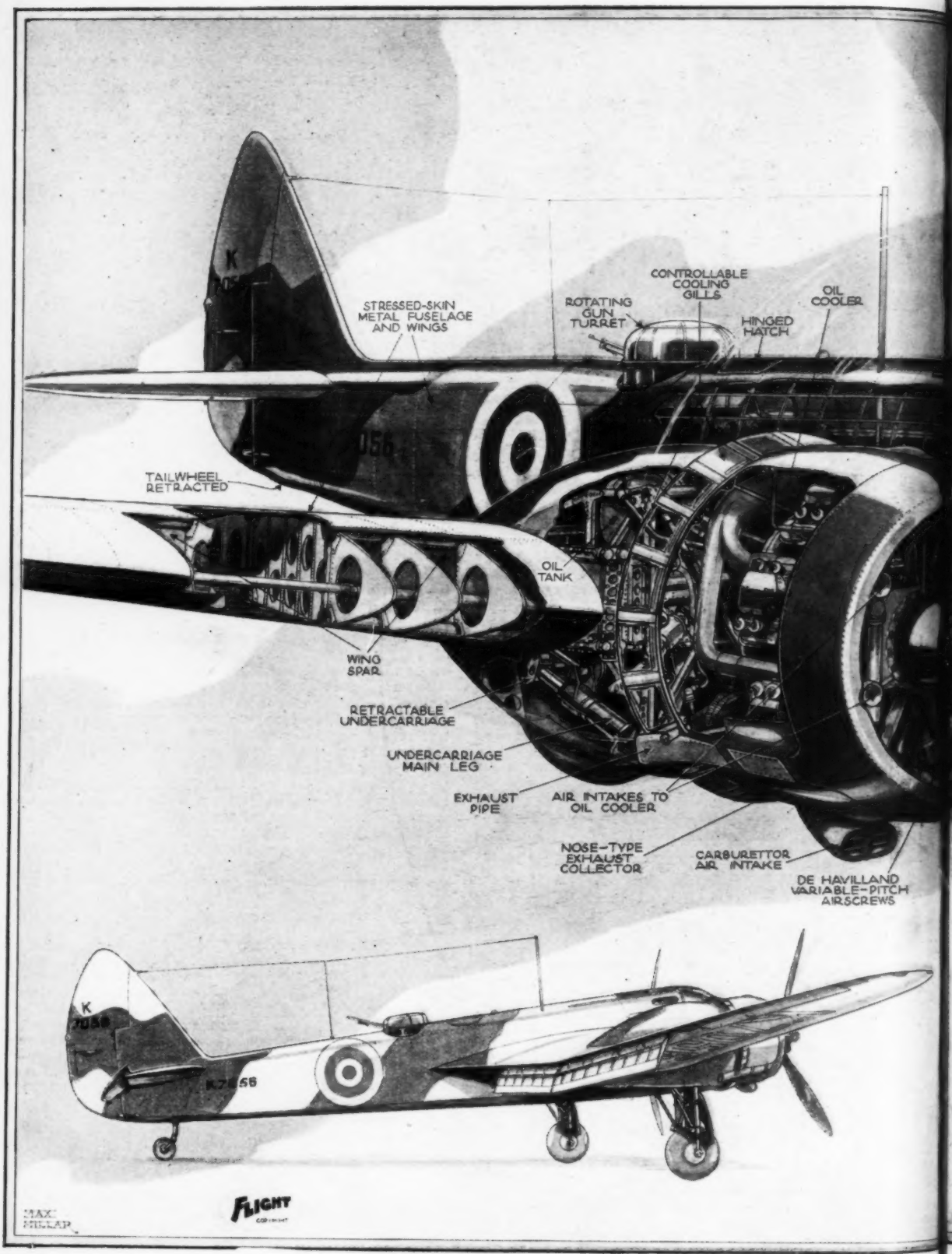
Since this machine will be one of the most interesting types to be seen for the first time at the Display in Service form, and since it is, virtually, a high-speed transport redesigned for military use, some impressions of the machine from the civilian pilot's point of view should be of interest to a number of people. Needless to say, the demand is so great that each machine as it comes off the assembly line is test-flown and delivered almost straight away to its squadron; Blenheims do not hang about at Filton. However, with the considerable assistance of the Bristol Company and of one of the London Club's Hornets it was possible to get over to Filton within three hours of the reception of a telephone message to the effect that one of them would be making its final acceptance flight that afternoon. Only one machine in ten is equipped with dual, and this one was not, but, sitting beside Flt. Lt. C. F. Uwins, the Company's chief test pilot, one could learn something of the machine's flying characteristics and discover the sequence of control operations.

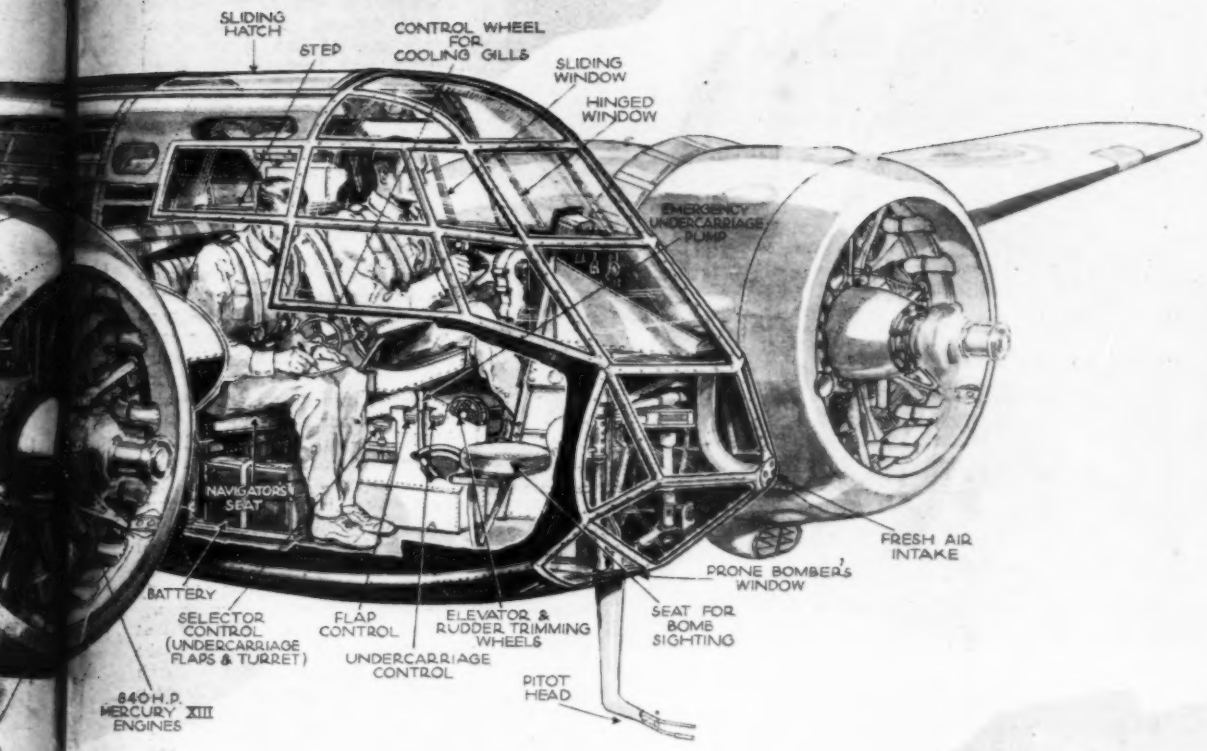
To the entirely uninitiated the control cabin of a modern twin-engined machine is something of a mysterious bag of tricks, but one lives and learns; in comparison with some transport machines of which I have had experience, the Blenheim's control layout is delightfully simplified. Everything is placed where it should logically be placed, and the pilot has merely to memorise the logical sequence of a series of actions while preparing either for the take-off or the approach and landing.

So far as flying is concerned, the civil-trained pilot would suffer two mild shocks in the Blenheim. First, the take-off acceleration is of the catapult order and the actual run is not much more than 300 yards. One does not expect that sort of thing in a comparatively large aeroplane. Secondly, the normal climb at about 140 m.p.h. is such that the "minute" hand of the Kollsman sensitive altimeter goes round like that of a clock with a broken escapement. Furthermore, though the machine is not really designed to be flung about, the pilot is not worried by dashboard notices to the effect that it must not be flown at a speed in excess of so-and-so miles an hour—generally about 20 m.p.h. higher than the normal maximum in high-efficiency civil machines. No doubt, however, reasonable care must be exercised, even in the case of the Blenheim. As far as noise is concerned, we of the civilian fraternity have been spoiled by the decibel-chasers. The Blenheim is just a flying machine, with no comforts,



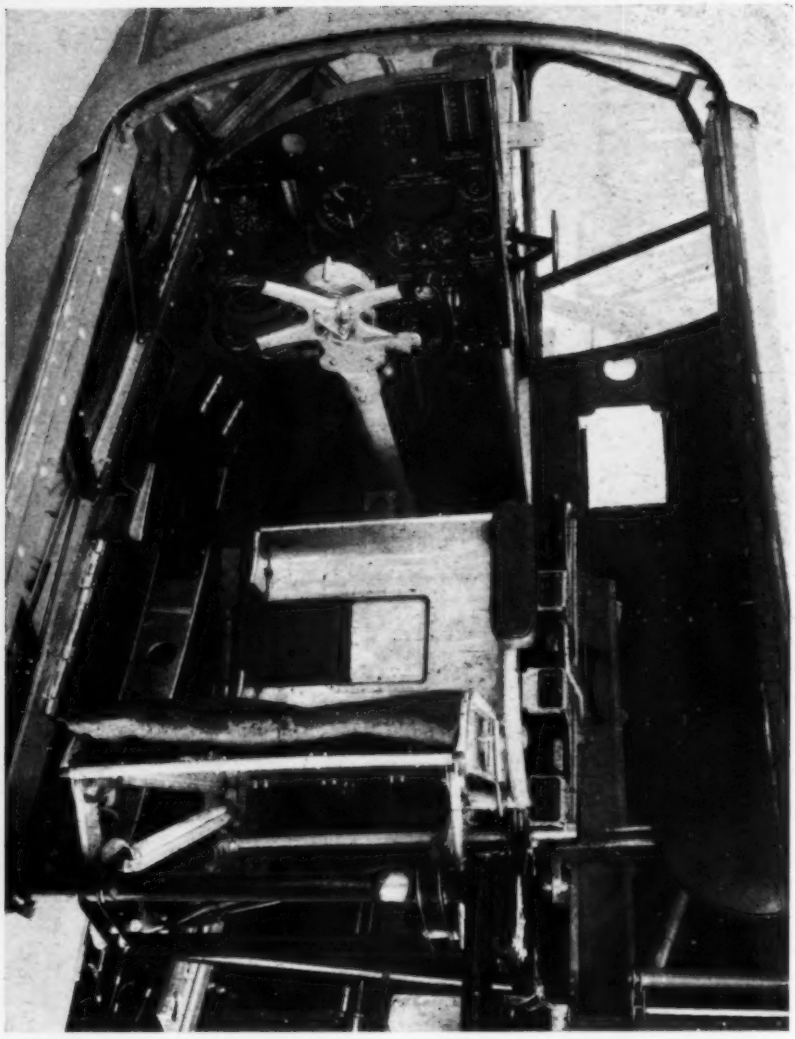
The fuselage of the Blenheim is made in three sections, each of a size suitable for transport. This sketch shows the tail unit with its retractable tail wheel, and the rear turret in its "flying" position.


CONTROLLABLE COOLING GILLS
OIL COOLER
ROTATING GUN TURRET
HINGED HATCH
STRESSED-SKIN METAL FUSELAGE AND WINGS
TAILWHEEL RETRACTED
OIL TANK
WING SPAR
RETRACTABLE UNDERCARRIAGE
UNDERCARRIAGE MAIN LEG
EXHAUST PIPE
AIR INTAKES TO OIL COOLER
NOSE-TYPE EXHAUST COLLECTOR
CARBURETTOR AIR INTAKE
DE HAVILLAND VARIABLE-PITCH AIRSCREWS
FLIGHT
MAX MILLAR



THE WORLD'S FASTEST STANDARD BOMBER

ALTHOUGH one or two smaller experimental types may be a shade faster the Bristol Blenheim medium bomber, which will appear at Hendon on Saturday as standard Service equipment, has most certainly a higher performance than any comparable machine in use abroad. Fitted with two Bristol Mercury VIII engines delivering a maximum of 840 h.p. each at 14,000ft. the Blenheim is capable of 280 m.p.h. The pilot has a fixed gun (mounted in the port wing), and there is a second weapon in the turret. Bombs are stowed internally in the bottom of the fuselage. Impressions of one who has flown in this magnificent aeroplane appear in the accompanying pages.



A plan view of the Blenheim's control cabin, showing the tidy instrument panel and giving some idea of the range of view provided for the pilot and bomber-navigator. On the right of the pilot's seat can be seen one of the two trimming wheels and the three hydraulic control plungers in line behind it; the trimming indicators are on the right side of the dash, while those for the undercarriage and flaps are on the left side of the cabin.

but only at speeds in excess of 200 m.p.h. is the airflow and engine noise really marked, and at 140 m.p.h., throttled well back, it is as quiet as one could wish. If passengers were to be carried it would be a simple matter to hunt out the origins of the various organ-pipe and other noises.

After the two Mercury VIIIs (each 840 h.p. at 14,000ft.) have been run up and the cowling gills opened by means of a hand-wheel to the right of and slightly behind the pilot, the rudder and elevator trimming wheels (placed together on the right) are adjusted so that the dashboard indicators show that the tabs are approximately in the neutral position, according to the load, and the hydraulically operated flaps are set in the 30-degree take-off position. In order to save later explanation, it may be as well to say that there are three vertically operated push-pull levers in a bank on the pilot's right, one to set the undercarriage jack in motion, another to operate the flaps, and a third, or "selector," to transfer the oil pressure, when necessary, from these to the jack which raises or lowers the rear gun turret. The necessary oil pressure is supplied by an engine-driven pump, and there is an auxiliary hand-operated pump, with a lever on the pilot's right, in case trouble is experienced with either the particular engine concerned, the pump itself, or the pressure lead system. The flap and undercarriage indicators are on the port side of the control cabin, the former showing particularly the "up," "take-off" and "landing" positions, and the latter incorporating a red and green warning light system. All the indicators are of the sliding-signal type, and there is the usual buzzer warning device which comes into action when the throttles are closed with the undercarriage retracted.

Just as soon as the machine has left the ground the undercarriage control valve is pulled up and the elevator tab wheel rotated to adjust the natural change of trim as the jacks do their work. The acceleration is most marked. Then the flaps are raised by pulling the second plunger (there is a momentary sink—rather like a pronounced down bump in a machine with this performance), and the three controls set in the "off," or neutral, position. Somewhat behind the pilot and on his left are the two D.H. airscrew pitch-changing plungers; these are pulled out with the expected "gear-change" effects. We are most definitely on our way—upward as well as forwards.

Even in coarse pitch and at an air speed of 140 m.p.h. the climb is phenomenal, though the engines, fully supercharged as they are, do not develop their maximum power until the machine has reached 14,000ft. Hence the desirability for the use of two-speed blowers in machines of this description.

By the time that 7,000ft. has been reached one has had a chance of realising just what good forward visibility means. In a military machine the need is obvious, but it is no less necessary in the case of civil machines. The field of view in the Blenheim is almost completely hemispherical, and as we cruised over the docks at Avonmouth I looked through floor windows and realised just how efficient as a piece of long-range artillery this Blenheim is. Only to port and starboard, where the big radials obstruct the view, is there a blind spot for the pilot—and the rear gunner will take care of that.

As a flying machine the Blenheim appears to be all that one should expect nowadays. The ailerons are reasonably light and the machine will turn and change bank accurately without use of the rudder. At cruising speeds she will turn with fair accuracy on the rudder alone, but at high speeds it appears that the machine has pronounced positive stability in the directional plane; the use of the rudder by itself merely induces a yawing motion while the machine carries on as before with a loss of speed. Incidentally—and the point might be incorporated in all larger machines—it is possible to adjust the position of the underslung rudder pedals in relation to the already adjustable

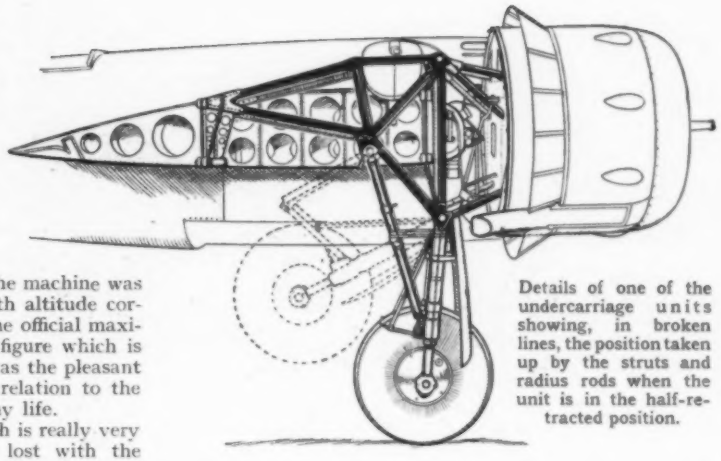
seat by means of a handle below the dash. When making steep turns in either direction Flt. Lt. Uwins used the trimming wheel by way of relieving the load on the control column; since this wheel is so conveniently placed and light in action there would be no hardship in so doing even if it was absolutely necessary. The rudder trim has a sufficiently wide range to allow the machine to be flown feet off with one engine not only throttled back but actually switched off.

At something rather less than half the full operating height it is fairly useless to talk of A.S.I. readings, but at 7,000ft. the machine was still accelerating at 230 m.p.h., which, with altitude correction, works out at about 260 m.p.h. The official maximum speed at 15,000ft. is 280 m.p.h.—a figure which is probably pessimistic. At any rate, there was the pleasant knowledge that I was travelling faster in relation to the earth's surface than I had ever done in my life.

The business of preparing for the approach is really very simple. After height has been suitably lost with the cowling gills almost closed, the hydraulic selector control is pushed downwards and the undercarriage valve plunger handle is pressed into the "down" position. A very gentle shuddering, caused by the irregular airflow over the tail surfaces, disappears as soon as the flaps are lowered in their turn, and the glide then is as steep as one might expect, and the machine is under full control right down to the stall, which appears to be innocuous enough. The normal approach is made at an air speed of about 90 m.p.h., and the aerodrome boundary is, if anything, undershot on principle, a burst of motor carrying the machine over the last hundred yards or so.

In this case the landing was made with the brakes on fairly hard—the control is by a thumb lever extending on the right side of the spectacles in the normal Dunlop manner—and after a full three-pointer the tail merely floated momentarily since what little load there was lay rather far forward. With a full load it should be possible to land with the brakes hard on whenever the surface permits of such tactics.

One day, when the possibility of war is no longer on the headlines, the design and production experience which has gone into the development of such types as the Bleuheim will enable us to make cheaper, faster and better transport machines.



Details of one of the undercarriage units showing, in broken lines, the position taken up by the struts and radius rods when the unit is in the half-retracted position.

SOME NEW BOOKS

Down the Flare-Path, by D. H. Montgomery. John Hamilton, 6s.

TO-DAY, nearly twenty years later, those who fought in the air war of 1914-1918 continue to exhume the past from brain and diary. *Down the Flare-Path* strikes a refreshingly new note. The author was a pilot in No. 101 Squadron, and was engaged mainly on night bombing work in France in F.E.'s. His story of his nightly duties in all sorts of weather in those draughty little pushers, told simply, straightforwardly and with real insight, paints the grim but humour-lightened picture most convincingly. We particularly liked this cameo, one of many:—

> Kneeling in his cockpit, which contained, by the way, no seat, my observer spread his map on the floor, studying it by the aid of a small pocket torch.
>
> Now there is, hinged and fastened to the side of an aerial Lewis gun a bag, designed to catch the ejected cartridge cases, and all unknown to Silvers this had become loose.
>
> Passing over the lines, German machine guns opened up, firing at us from below. Keeping his map on the floor with his left foot and right knee, my observer replied, firing downwards over the right side of his cockpit. As the ground receded underneath us, he stood up to get a better view, firing back under the wing, and from that moment he forgot his map. It was at this point that the ejector bag slipped from his gun, and a stream of empty cartridge cases passed an inch above my head, beating a tattoo on the radiator and wires. Some passed out through the propeller which revolved behind.
>
> "What's that?" I yelled, and Silvers, who had silenced the German gunners with his remaining ammunition, saw at this moment his ejector bag flapping. His face came over the windscreen.
>
> "Did you get any of 'em?" he shouted. Before I could reply his goggles, perched on his forehead, left his helmet and disappeared like a flash over my head and through the propeller. Then came the map! Nine square feet of canvas-lined paper! As it passed over his head Silvers made two wild grabs at it, but it eluded him. With a shout of "Hold the stick for me a minute," I stood on my seat and looked back over the engine just in time to see the map become dislodged from the centre section cross-bracing wires and travel on to the brilliant red exhaust pipe. The now flaming mass of paper was just within reach, and in the terrific draught one push sent it through the propeller. The long-suffering blades had already withstood the onslaught of two dozen cartridge cases and a pair of goggles, and they swallowed the burning map at a gulp.
>
> By this time the machine had her nose in the air sideways, and I slid back to my position at the controls. Silvers held on tight to his one remaining possession, the machine gun!

The book is illustrated with some extremely good black-and-white sketches by Stanley Orton Bradshaw.

Clouds of Glory, by John Moore. Dent, 7s. 6d.

HERE we have a psychological study of the long-distance record-breaker's mentality—or more accurately, of the mental reactions of two record-breakers, a man and a girl, blessed (or cursed) with far more imagination than most of their kind. Sponsored by a stunt-worshipping newspaper proprietor (Mr. Moore draws the portrait perfectly), the two fly round the world in opposite directions, to be reunited for a front-page marriage. The records are broken, but the newspaper's go-getting representative in Australia proves the last straw of the utterly weary hero and heroine; they flee in a tramp steamer—unmarried.

The author (his dedication is "To Dick Northway and G-ABER") knows his aeroplanes.

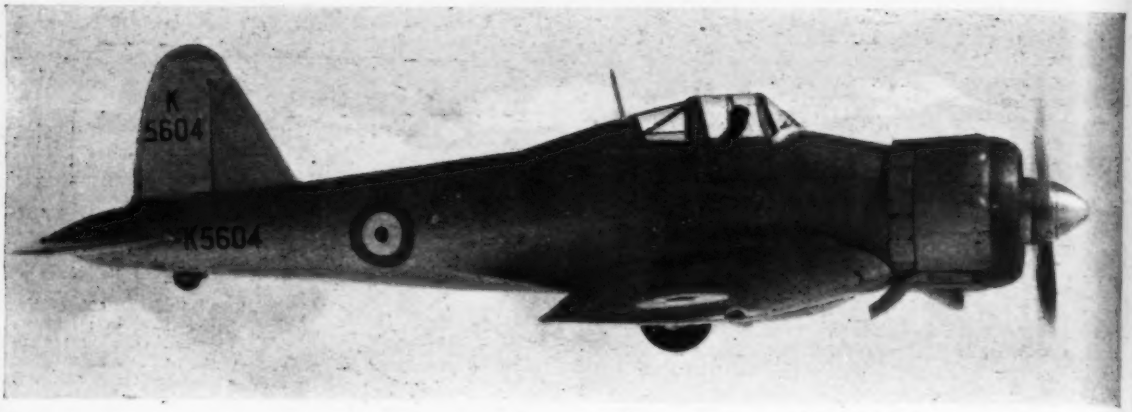
Signpost—An Independent Guide to Pleasant Ports of Call, by W. G. McMinnies. Simpkin Marshall, 3s. 6d.

MAJOR McMINNIES (who members of the Industry will recall as one-time publicity manager to Armstrong Siddeleys), spends much time in motoring round Great Britain in search of these pleasant ports—hotels, restaurants, road-houses—and in this 340-page guide he tells us about his discoveries. Everything is beautifully tabulated, and those caravanserais that cater for the flying visitor are clearly indicated.

But we still await the perfect guide-book that tells us which hotels *not* to call at.

The Roadreader—The Easiest Road Map in the World. Ivor Nicholson and Watson, 7s. 6d.

FOR the motorist who has no use for the wealth of topographical information given by the Ordnance Survey type of map—he who is too intent upon getting from *x* to *y* to be interested by such mundane things as contours—this map-book of England, Scotland and Wales should prove thoroughly handy. It is arranged on the patented Berquist easy reference system, by which the continuation of a route on to another page can be instantly followed. Aerodromes are indicated, and there are throughway maps of large cities.



The new Gloster multi-gun fighter monoplane fitted, at the moment, with a Bristol Mercury engine. Another view appears on page 646. (*Flight* photograph.)

"NEW and EXPERIMENTAL"

Nine Experimental Types on View at Hendon : Three Interesting Trainers

AT the time of going to press it seems that there will be nine aircraft in the park devoted to new and experimental types. It is customary for the occupants of this enclosure to fly past toward the end of the display. This year their number will include the Gloster monoplane fighter, the Hawker Henley light bomber and the Fairey to the same specification, the Blackburn fleet fighter dive bomber, the De Havilland Don, Airspeed Oxford and Miles P.V. advanced trainer, the Airspeed un-named wireless-controlled target machine, and the De Havilland Albatross long-range transport.

Information on the majority of these types is very limited, but the following notes, in conjunction with the photographs, will give some idea of their nature:—

Gloster F.5/34 Single-Seater Fighter.—An all-metal low wing cantilever monoplane with such modern refinements as retractable undercarriage, D.H. variable-pitch airscrew, flaps, cockpit enclosure and long-chord engine cowling with leading-edge collector ring and controllable gills, the Gloster F.5/34 has recently made its initial flights. At the moment the power plant is an 840 h.p. Mercury, but this may eventually be replaced by a new type of fully supercharged Perseus sleeve-valve engine.

Dimensions are:—Span 38ft. 2in., length 31ft. 1in. and height 10ft. 7in.

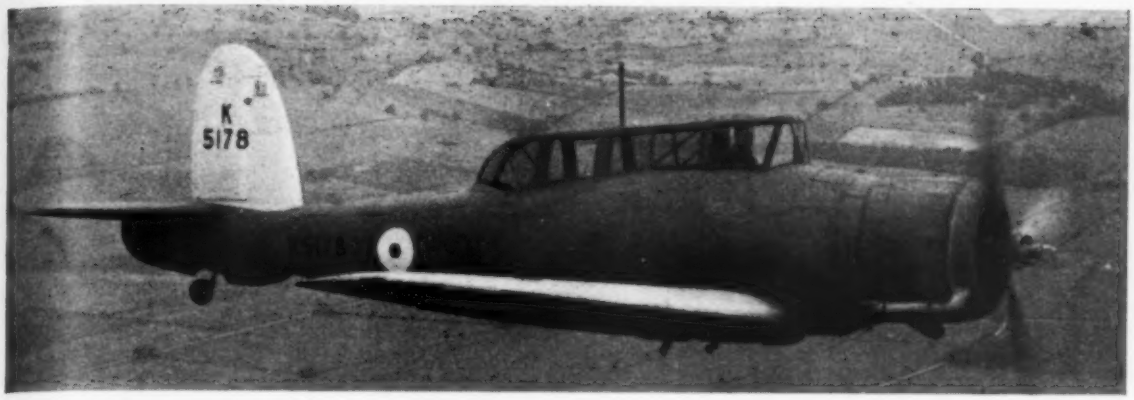
Fairey P.4/34 Light Bomber.—A shapely low-wing all-metal cantilever monoplane, the Fairey "P.4," as it is called for convenience, is powered with a Rolls-Royce Merlin (990/1,050 h.p.), which is provided with a ducted radiator. There is no evidence of internal bomb stowage, but flaps, D.H. variable-pitch airscrew and retractable undercarriage are specified.

In a number of respects this machine bears a resemblance to the Battle medium bomber now in large-scale production for the R.A.F., but is lighter, smaller and faster. It is likely that this machine is the world's fastest single-engined bomber.

Hawker Henley Light Bomber.—Built to meet the requirements of Air Ministry specification P.4/34, the Henley bears a distinct resemblance to the Hurricane single-seater fighter

Built to the same specification—P.4/34—the Fairey and the Hawker Henley Merlin-engined light bombers are undoubtedly the fastest machines of their calibre in the world. (*Flight* photographs.)

OUR NEWEST LIGHT BOMBERS



Intended for fighting and dive bombing duties the new Blackburn monoplane is fitted with a Bristol Mercury, which may later be replaced by a Perseus. (*Flight* photograph.)

ordered in quantity for R.A.F. squadrons. Trailing-edge flaps, a D.H. variable-pitch airscrew, a retractable undercarriage and a neatly designed cockpit enclosure are incorporated. The engine is a Rolls-Royce Merlin (990/1,050 h.p.) which is provided with a radiator mounted well forward and enclosing the oil cooler and air intake.

The machine is arranged as a mid-wing monoplane and carries its bombs in "belly" compartments.

Blackburn Fleet Fighter Dive Bomber.—Built to a particularly exacting specification this, the latest Blackburn aeroplane, is intended for operation from aircraft-carriers. At the moment the engine is a Bristol Mercury, installed in a gilled cowling, but this may eventually be replaced by a sleeve-valve Perseus. A crew of two is normally carried.

Points of special interest on this striking aircraft are the watertight fuselage, which precludes the provision of flotation gear, and the folding wings, which facilitate stowage in the hangar of a carrier. The design of the tail unit will undoubtedly occasion much comment. In this, the fin and rudder are set well forward in relation to the tail plane.

Phillips and Powis (Miles) Private Venture Advanced Trainer.—Capable of 290 m.p.h. when fitted with the fully supercharged Rolls-Royce Kestrel XVI engine, this graceful monoplane has only lately been completed. It is eminently suitable, not only for training purposes, but as a first-line military type, and should interest particularly nations with comparatively impecunious air forces.

The installation of the Kestrel will undoubtedly be generally admired, and the "inverted gull" type wings are also worthy of particular note. The undercarriage retracts rearwards and Miles split trailing-edge flaps are fitted.

De Havilland Don: Ordered in quantity for advanced training work, the Don is a low-cantilever-winged monoplane with D.H. variable pitch airscrew, flaps and a retractable undercarriage. The Don is fitted with one of the new "Gipsyking" inverted vee-twelve air-cooled engines, "Gipsyking" being the Service name for the Gipsy Twelve as fitted in the Albatross.

Instructor and pupil are seated side-by-side and there is a gun turret aft of the cockpit enclosure.

It will be noted that the cooling air for the engine is taken in through wing tunnels, the entry ducts being faired in with the undercarriage gear. The design of the tail is also worthy of note, there being narrow forward extensions of the tail plane.

A Twin Trainer

Airspeed Oxford Advanced Trainer.—A twin-engined monoplane, the Oxford may be regarded as a development of the successful Envoy civil transport. It differs from the Envoy, however, in several features, notably in the forward portion of the fuselage, which allows dual controls to be fitted. An Armstrong Whitworth gun-turret is fitted aft of the wing and a light bomb load may be carried for training purposes.

The engines are two Armstrong-Siddeley Cheetahs, which drive D.H. variable-pitch airscrews. A retractable undercarriage and trailing-edge flaps are features.

Airspeed Wireless-Controlled Target: Very little information is at the moment available on this Cheetah-engined machine. It is rumoured that it will be given the name Queen Wasp.

Great Britain is well ahead of other nations in producing wireless-controlled target aircraft to provide practice for the crews of anti-aircraft guns.

De Havilland Albatross Transport: One of two machines of this type ordered for transatlantic experiments, the Albatross to be seen at Hendon made its first test flights a

A "private-venture" machine, the new Miles advanced fighter-trainer is powered with a Kestrel XVI which gives it a top speed of 290 m.p.h. (*Flight* photograph.)

The De Havilland Don advanced trainer, ordered in quantity for the R.A.F., is fitted with the D.H. Gipsyking inverted vee-twelve engine, better known as the Gipsy Twelve. (*Flight* photograph.)

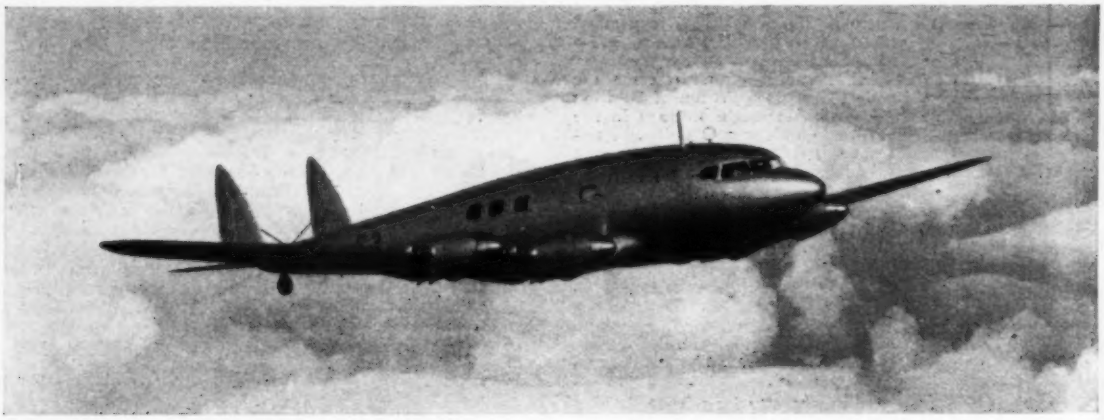
few weeks ago. Powered with four of the new twelve-cylinder inverted vee air-cooled Gipsy Twelve engines of approximately 500 h.p. each, the cruising speed is in the neighbourhood of 200 m.p.h.

One of the unorthodox features of the Albatross is the cooling system used for the engines. Air is taken in through tunnels in the leading edge of the cantilever wing and led round the cylinders. Thus it is possible to enclose the complete engine in a shapely nacelle of very small cross section.

The Albatross is mainly of wood, Bakelite plywood being extensively employed. The wing is constructed on the lines of that of the famous Comet.

Although the two "Albatrii" ordered by the Air Ministry are fitted with extra tanks for the Atlantic crossing, the remainder of the initial batch are equipped for medium-range work and have accommodation for passengers, mail, and freight.

Obviously, the Albatross is potentially a long-range bomber of great striking power, but so far no military version has officially been foreshadowed.



One of the most impressive transport aeroplanes ever built, the De Havilland Albatross is estimated to cruise at about 200 m.p.h. Its four engines are Gipsy Twelves. (*Flight* photograph.)

Forthcoming Events

June 21-28. Federation Aeronautique Internationale: London Conference.
June 26. Royal Air Force Display, Hendon.
June 28 and 29. S.B.A.C. Display, Hatfield.
July 1. Aero Golfing Society: *Flight* Trophy.
July 3. Newcastle-on-Tyne Aero Club: Newcastle Trophy Race.
July 3. Ramsgate Airport, Official Opening.
July 4. Brooklands Club: Supper Patrol.
July 4-18. Aero Club of Germany: Wasserkuppe Gliding Meeting.
July 10. Cardiff Aeroplane Club: London-Cardiff Race.
July 10. Lancashire Aero Club: Garden Party.
July 11. Herts and Essex Aeroplane Club: Air Display Broxbourne.
July 11. Italian Aero Club: Circuit of Rome.
July 15. Aero Golfing Society Jubilee Cup.
July 17. Portsmouth Aero Club: Garden Party.
July 17-18. Deauville Rally.
July 23-August 1. Swiss International Meeting.
July 24. Devon Air Day and Race: Plymouth and Exeter.
July 30-August 15. "Avia" Aero Exhibition, the Hague.
July 31. Cinque Ports Flying Club: Folkestone Aero Trophy Race.
July 31-August 2. Yorkshire Gliding Club: Opening Meeting Sutton Bank.
August 1-14. Yorkshire Gliding Club: Instructional Camp, Sutton Bank.
August 3-September 7. Public Schools Aviation Camp. Norwich.
August 6-7. Austrian Aero Club: International Rally, Lake Worth.
August 14. Eastbourne Flying Club: At Home.
August 14-22. Yorkshire Gliding Club: Open Contest, Sutton Bank.
August 21. Thanet Aero Club: Aviation Meeting and Race.
August 21. Midland Aero Club: "At Home."
August 22-29. Italian Aero Club: Circuit of Littorio.
August 28 and 29. Cinque Ports Flying Club: Lympne International Rally and Wakefield Trophy Race.
August 28-September 25. B.G.A. National Soaring Competition, Great Hucklow.
September 4 and 5. Southend Flying Club: "At Home."
September 10-11. R.Ae.C.: King's Cup Race.
September 12. Aero Club de France: Coupe Deutsch de la Meurthe, Etampes.
September 23. Aero Golfing Society: Cellon Trophy.

EMPIRE AIR DEFENCE

Deserts are quite a usual feature of overseas air work. Here Vickers Valentia transports are seen carrying supplies from Egypt to Palestine.

Strategical Problems Discussed

By MAJOR F. A. de V. ROBERTSON, V.D.

THE problems before the Air Force overseas are very different from those which confront the Air Force at Home. The two sections of the R.A.F. must be prepared to act independently and must not count much on the one receiving any help from the other. So long as there is any possibility of the homeland being attacked, the Metropolitan Air Force (with the exception of the army co-operation squadrons) is tied to the frontiers of the homeland—though the frontier may be on the Rhine. Mobility is only a minor consideration with the Home force; it must practically always remain based on the British Isles.

The circumstances of the Air Force overseas are quite different. It is divided up into six different Commands, none of them holding any great strength in squadrons, and therefore, if trouble were to break out at any one point, the squadrons in that area would expect speedy reinforcement from neighbouring Commands. All these Commands are at present organised only for participation in operations where the enemy will not have any aircraft, or at least any worth serious consideration. That is say that as yet there are no fighter squadrons in any of the overseas Commands, only bomber squadrons, army co-operation squadrons, bomber transport squadrons, torpedo bomber squadrons, and flying boat squadrons. The bomber transport squadrons are typical of the stress which the overseas R.A.F. places on the need for mobility and for reinforcement, for such units are not maintained in the United Kingdom. They can be used for moving up ground troops or for carrying the baggage and spares of an operational squadron, which is really not mobile unless these impedimenta can accompany it. One example of the mobility of the overseas R.A.F. was seen when the revolution was taking place in Afghanistan, and transport aircraft were quickly flown up from Iraq to India to evacuate the foreigners from Kabul.

These Commands are strung out along the route to Australia, and each is centred at some focal point or in some important area. Each is within reinforcement distance of the next, and every year squadrons practise formation flights from one Command to another. Moving along the eastward route we first come to the R.A.F., Mediterranean. It is at present a small Command, presided over

Malta is the headquarters of the Mediterranean Command, but soon there will probably be another air base in Cyprus.

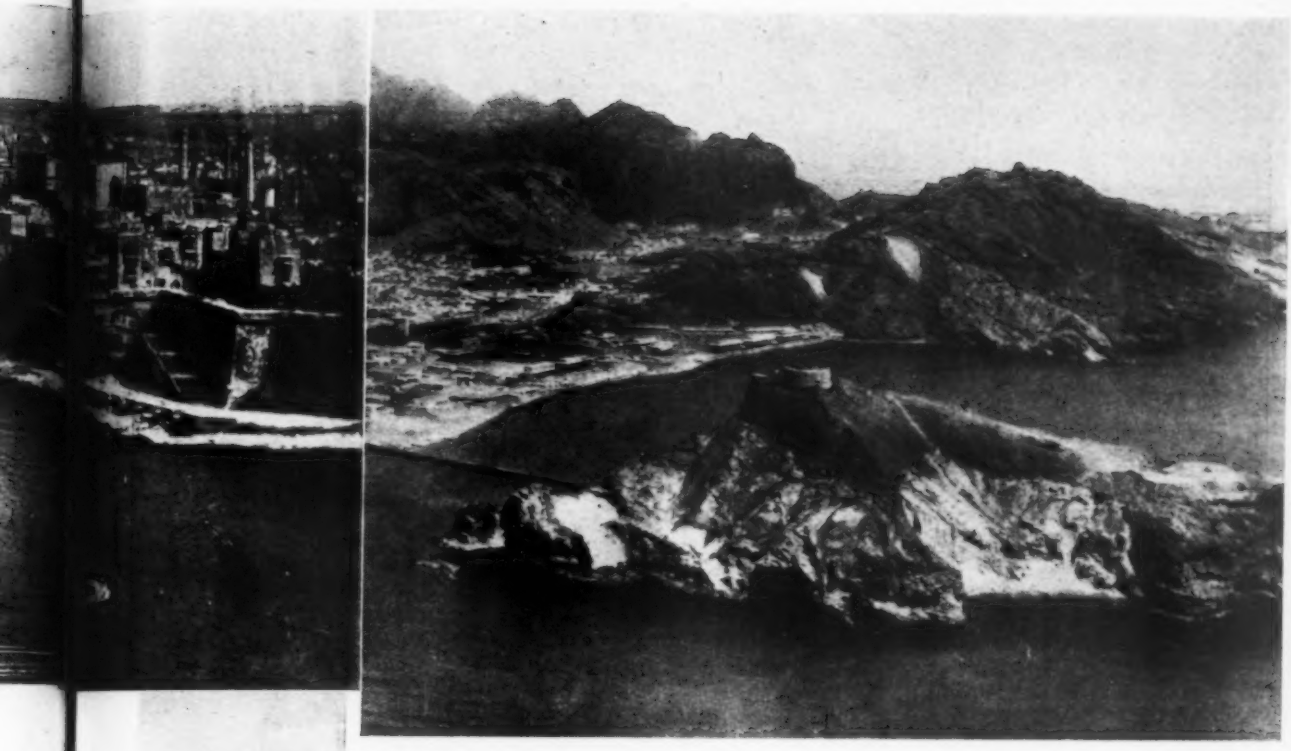
by an Air Commodore, and in one word it means Malta. The Mediterranean, being a sea, must be primarily the concern of the Royal Navy, and the Air Force there must be prepared to work with the Fleet. Malta provides the shore base for units of the Fleet Air Arm, and it also is the home of one flying-boat squadron, which is equipped with Scapas.

It is the intention to make another air base in the Mediterranean on the island of Cyprus, and that will considerably strengthen our position in that sea. A Mediterranean agreement has been signed by Britain and Italy, to the satisfaction of both parties, but Britain must always be prepared for unwelcome developments, and eighteen months ago relations with Italy were strained. It was said at the time by pessimists that the Italian Air Force could make Malta and Alexandria untenable. It must be remembered that Italy herself is in the Mediterranean, and would herself be in grave danger if she became involved in war with a strong air Power in that sea. The interests of the two countries there are so tangled up that it is obviously to the advantage of both to keep the peace. It is quite necessary for Britain to be strong there, or the above argument would not apply.

Proceeding eastward we come to the Command known as R.A.F., Middle East. This is a Command of many interests. It cannot be unconcerned with Mediterranean affairs; it has a subordinate Command in Palestine and Trans-Jordan; it must defend the Suez Canal and all that that means; it watches over the peace of the Sudan; and just lately there has been added to it a bomber squadron at Nairobi in Kenya. This last development is a result of the conquest of Abyssinia by Italy. As there are now European aircraft in that part of Africa, the British position there has been considerably modified. Kenya lies due south of Abyssinia, and previously there was no reason for keeping a unit of the R.A.F. in that delectable colony. Now a beginning has been made in establishing an air garrison, while a retired Air Chief Marshal has been appointed Governor of the Colony. Obviously the Kenya garrison will have to be increased, and it seems equally obvious that in due course that garrison will have to include defensive fighter squadrons.

According to the recently signed treaty with Egypt our Air Force in that country may be largely increased, but must be concentrated in the Canal zone. That is in deference to Egypt's newly acquired status as an independent kingdom. The

The N.W. Frontier of India provides few emergency landing grounds, but R.A.F. pilots are rarely let down by their engines. Here is seen a formation *en route* to Gilghit.
(R.A.F. official: Crown copyright reserved.)



Aden has only a small garrison, but its strategic position is immensely important.

(R.A.F. official: Crown copyright reserved.

The Suez Canal has been called the main artery of the Empire. The R.A.F. squadrons in Egypt will soon all be quartered along its banks.

(R.A.F. official: Crown copyright reserved.)

Egyptian point of view is easy to understand and respect.

Subordinate to the Middle East Command is the R.A.F. in Palestine and Trans-Jordan. Up to the time of the recent Arab riots in Palestine the R.A.F. was in supreme charge of the defence of those two mandated territories, and any Army troops there were under the command of the A.O.C. This arrangement was an experiment on the model of the successful air control in Iraq. But Palestine did not prove an equally suitable country for air control. Riots were apt to break out in the towns, and with these aircraft are always unable to deal. The operational command was therefore transferred to an Army officer, but there is a combined General Headquarters Staff composed of officers of both Services. Across the Jordan the squadron at Amman keeps an eye on the Beduin tribes, for which task aircraft are eminently suitable.

Palestine and Trans-Jordan together make an important link in the overseas Air Force chain. The Command extends to the eastern shore of the Mediterranean, it is in touch with the Air Force in Iraq, and, of course, also in touch with that in Egypt and the Sudan. It is a small Command, but may be regarded as a nucleus which could be increased if the need arose.

Moving farther eastward we come to another small but important Command, known as the British Forces in Aden. Here the R.A.F. is in supreme control, and the Air Officer Commanding has Army units under him. The air garrison consists of only one bomber squadron and a section of armoured cars, and its normal work is to keep the peace among the tribes of the Hinterland. It does this most efficiently, with a minimum of fuss and next to no bloodshed. But it is interesting to look at the map and study the strategic position of Aden. The importance of this Colony has been greatly increased since the Italian conquest of Abyssinia, for it lies directly on the north-eastern flank of the Italian possessions in Africa. The Abyssinian port of Massawa is within reach of a bombing force stationed at Aden, while the Straits of Babel Mandeb could hardly be navigated if the Aden Air Force was determined to keep them closed. At present the Aden garrison is also a nucleus, but it too

Hong Kong is the most easterly outpost of the R.A.F. At present no squadron is stationed there, but preparations are being made to receive one. The station of Kai Tak is part of the Far East Command, whose headquarters are at Singapore. (Photograph: *Ming Yuen, Hong Kong*).

could be increased. Probably this will soon be done.

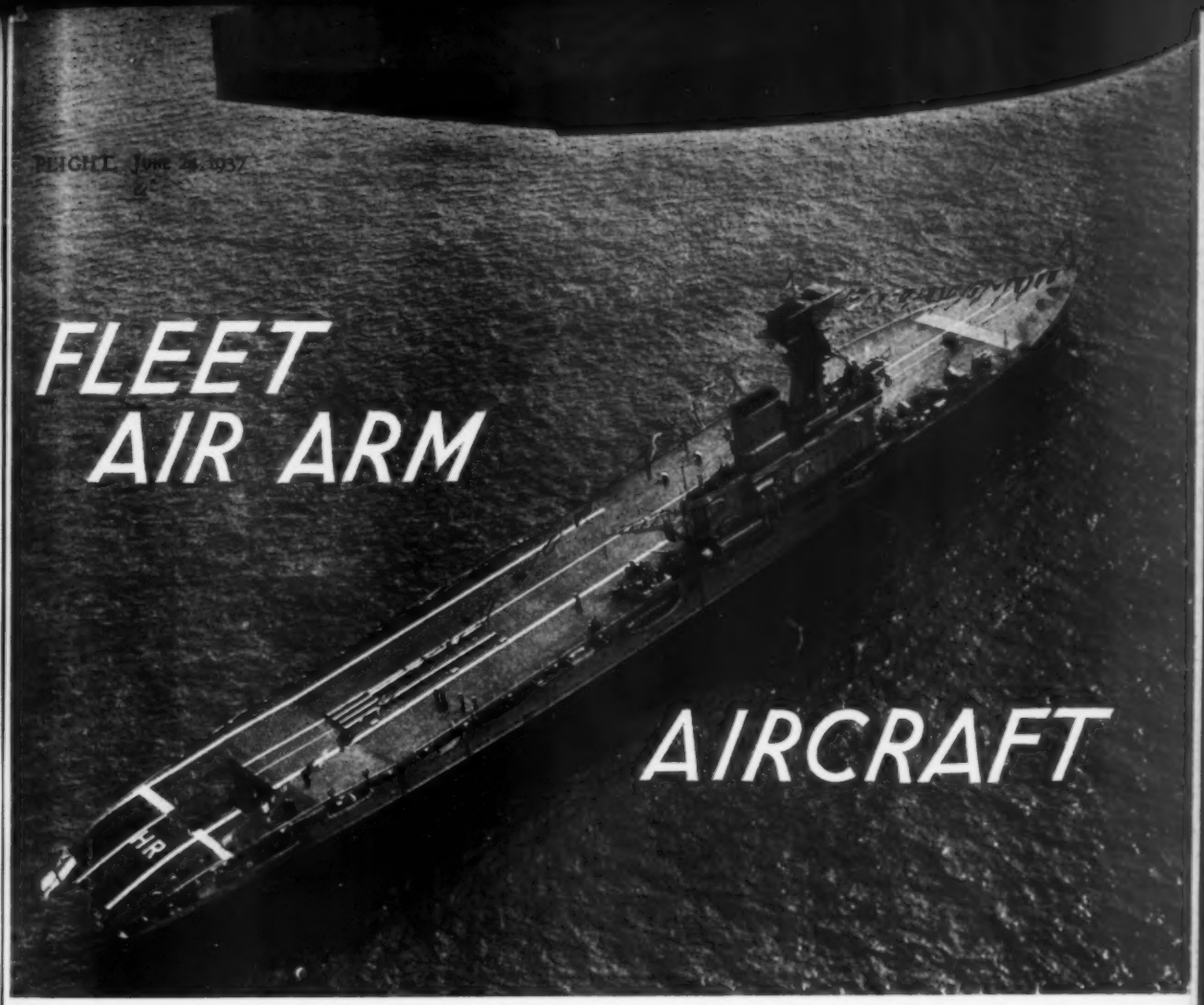
From Aden our eyes must turn due northwards to Iraq, where an Air Force of some strength is maintained. Iraq was once mandated territory, but now it is an independent kingdom, allied to Britain. By the treaty between the two countries the R.A.F. stations at Hinaidi (outside Bagdad) and Mosul are to be handed over to the Iraqi Flying Corps, and the British squadrons are to concentrate at Dhibban on the Euphrates. The flying boat squadron at Basra will have to remain where it is. Iraq is the outstanding success of the policy of air control. The A.O.C. commands any British forces which may be in the country, and by transferring the control of the country from the Army to the R.A.F. Mr. Winston Churchill has saved the British taxpayer many millions of money, and has also saved many British and tribal lives.

Strategically, the R.A.F. in Iraq has no very serious problems of its own. In early days there was a dispute with Turkey about the boundary in the neighbourhood of Mosul, but that matter has been satisfactorily settled. The squadrons at Dhibban and Basra, however, make an excellent reserve force for flying to the help of Aden, the Middle East or of India, as may be required. They also have the task of protecting, and occasionally helping, the machines of Imperial Airways (to say nothing of Air France and K.L.M.) as they pass through.

The R.A.F. in India is an important Command, but it is very difficult to write with confidence about its functions. Army officers are inclined to speak of it as an invaluable aid to military operations, but as nothing more. Air Force officers, on the other hand, sometimes suggest that if only the Army would stand aside and hand over the whole frontier problem to the Air Force, then the Mahsuds would cease from troubling and the Afridis would be at rest. It seems impossible to get an impartial opinion. It may, however, be said that the eight squadrons are organised into three Wings of two squadrons each, while two squadrons are directly under the Command Headquarters. Nos. 1 and 2 Wings together form No. 1 (Indian) Group, and all the four squadrons in that Group are bombers. No. 3 (Indian) Wing is comprised of two Army co-operation squadrons, and the two H.Q. squadrons are also of that class. All the Wings are stationed along the N.W. Frontier, while one of the H.Q. squadrons is at Ambala in the Punjab and the other at Karachi.

Finally, we come to the Far East Command with its headquarters at Seletar, Singapore, and an outlying station at Kai Tak, Hong Kong. This Command has been slowly but steadily growing in importance, and though it has not yet been honoured by having an Air Vice-Marshal as its A.O.C., it already boasts five squadrons, two of torpedo bombers, two of flying boats, and the Straits Settlements Volunteer Air Force. To what size this Command will ultimately grow, as the naval base at Singapore is developed, cannot be foretold, but certainly the Command has not yet attained its full stature. Its function is to co-operate with the Navy in protecting British interests in the Indian Ocean. It is also the guardian of the penultimate stage of the civil air line to Australia. Looking ahead, one can see the Royal Air Force units from Singapore able to reinforce the Royal Australian Air Force in time of need; and conversely the R.A.A.F. might reinforce Singapore. In due course New Zealand will have increased its Air Force to a size which will make it a factor in the strategical position in the Pacific.

FLEET AIR ARM AIRCRAFT



The aircraft carrier *Hermes*, 10,850 tons ; speed, 25 knots ; length, 599 ft. 6 in. She was completed in 1927.

Special Problems that Face the Designer of Machines for Aircraft-Carrier Operation : Easing the Pilot's Task : Details of Deck-flying Routine

By H. J. C. HARPER, A.M.Inst.C.E., A.F.R.Ae.S.

IT is the object of this article to describe the conditions under which aircraft in a carrier operate and to give some idea of the special problems which confront the designers of such aeroplanes. It must be obvious to every reader of *Flight* that an unrestricted view for the pilot and good control at slow speeds are essential for deck landing—to which statement the natural answer is, "Well, of course, that applies to every aeroplane." True, but the land aeroplane has not to alight on a narrow strip of aerodrome less than ninety feet wide, which is moving forward and may be rolling and pitching at the same time. Thus view and control must be better than that of the average landplane.

Thus the design of Fleet Air Arm aircraft is no easy task, and, moreover, the designer is faced at the outset with restrictions with regard to span, width, length and height. The first three of these have of necessity to be imposed so that the machine may be moved on to the lifts for transit between flight deck and hangars, and also to allow the required number of aircraft to be stowed in the hangars while still leaving a working space around each. The height of the ship-plane in the tail-down attitude is restricted by the head room available in the hangar. Aircraft carriers are of necessity unwieldy craft and difficult to handle in a narrow tideway in a strong wind owing to the amount of top hamper. Every extra foot of head room makes this state of affairs worse and raises problems of construction to keep within the allowable tonnage and to maintain the stability of the ship.

When ship-planes are being flown-off or landed-on, the carrier steams ahead directly into wind. Obviously, the wind over the deck is the sum of the natural wind and the artificial wind created by the forward speed of the ship. If the ship-plane has a high landing speed then a higher wind speed over the deck is required. If there be little natural wind, then the ship will have to steam fast to take on board its aircraft. This has several serious operational objections. First, at such high ship speeds the consumption of oil fuel will be greatly increased and the operational range of the carrier correspondingly reduced. How serious this is can be judged from the fact that increasing the speed from twenty to twenty-five knots doubles the oil fuel consumption, and a further increase from twenty-five to thirty knots doubles it again. In peace time the cost of oil consumed is a matter of importance, as at high speeds this amounts to £100 an hour. Secondly, high speeds result in excessive wear and tear on the machinery and necessitate more frequent docking. A third important consideration is that it often happens that when the carrier is required to operate her aeroplanes, the Fleet is steaming down or across wind, and consequently the carrier has to steam away from the Fleet; this may take her into the proximity of enemy ships, the shore or shoals. If much time elapses she may find herself far removed from the main body and for a time will be somewhat isolated and unprotected. This is always a potential source of worry to the Commander-in-Chief. The faster she has to steam the greater the separation and the longer the time it will take her to get into station again.

"Entry into the arrester gear at too high a speed throws a great strain on both the aircraft and the deck cables." This remark of the author's can be readily appreciated by a study of this photograph, which shows a Hawker Nimrod being checked by an arrester cable on the deck of an aircraft carrier.

With deck-flying, speed of operation is of the utmost importance and calls for good organisation and drill. It may therefore be of interest if a brief description be given of the procedure adopted. The aircraft to be flown-off are brought up on the lifts from the hangars below decks and are ranged up behind each other on the flight deck. Often two or more squadrons are so ranged up at the same time. Chocks are placed in front and behind the wheels, and the windscreen at the forward end of the flight deck is raised to break the force of the wind on the ranged aeroplanes. To assist rapid ranging-up it is essential that the machines should be capable of being handled easily with the wings folded, that the wings can be quickly spread and that the aircraft can be handled easily on the flight deck either nose first or tail first.

After the engines have been warmed up and tested, the windscreen is lowered and the ship turns into wind, the wind direction being indicated by a steam jet which must be kept within a few degrees of the centre line of the ship. When the Wing Commander and the Captain are satisfied that there is sufficient wind directly down the deck he gives the word to fly-off. The Flight-deck Officer, who is in charge of operations on deck, gives the signal for the first machine to take off. The front chocks are removed, the pilot opens up his engine and after a short run is in the air. The process is repeated until in a very few minutes the whole squadron has taken off and has got into formation. The second squadron may be flown-off immediately afterwards. Flying-off is a comparatively simple process, but, of course, there must be no tendency for the aircraft to swing, otherwise it may go over the sides or collide with "the island," as the ship's superstructure is called. This has occurred on more than one occasion. Rapid acceleration is essential in order that the take-off run may be as short as possible. This means a good power/weight ratio. If the run be unduly long, it either imposes a restriction on the number of aircraft which can be ranged up, or means faster steaming of the ship.

Landing-on is a far more difficult process. The flight deck is none too long—less than 600 ft. in most cases—but it is the narrow width which calls for the skill and concentration of the pilot. It must be borne in mind that pilots often have to land when fatigued after a four- or even eight-hour patrol over the featureless sea. It is essential, therefore, that everything possible should be done to make the process as easy as possible.

Landing Difficulties

A slow landing speed is particularly desirable, and special means (such as flaps) will be necessary with future cleanly designed high-speed aircraft. Entry into the arrester gear at too high a speed throws a great strain on both the aircraft and the deck cables. In one of the aircraft carriers of a certain foreign power an arrester wire broke during a particularly fast landing, and the flailing ends decapitated one of the deck party and cut off the legs of another.

The actual process of landing-on is very different from alighting on an aerodrome, as the deck is moving forward all the time, and in rough weather may be rolling and pitching considerably. The usual procedure is for the pilot to make his approach so that when at a distance of 100 to 150 yards astern of the ship he will be aligned on the centre line and at such a height that he will eventually pass about 20 feet above the after end of the flight deck.

"Landing-on is a far more difficult process . . . everything should be done to make it as easy as possible" Blackburn Baffins coming in.

During this final part of the approach he must watch the deck closely and adjust his height, which is liable to constant variation owing to the effect of air disturbances. It must be remembered that if he is too high he cannot correct by putting the nose down, for if he does so he will gain too much speed—a very frequent mistake with beginners. He must throttle down until he has lost the required height, as side-slipping or "S" turns are difficult to execute without getting off the correct line of approach. If a downward bump is experienced a burst of engine must be used to regain height.

As soon as the after end of the flight deck is reached the pilot must throttle back and make a normal landing, being particularly careful to keep directly into wind and as near the centre line as possible. Broad double white lines are painted along the middle of the deck to serve as a guide. If for any reason the pilot finds himself off the centre line he must at least keep parallel to it, for to swing off will put the aircraft across the high relative wind. This may be as high as thirty knots, and the inevitable tendency to drop one wing will occur, so further increasing the swing until the aircraft runs into the palisades or over the side. These palisades consist of stanchions spaced some eight feet apart with wires strung between them. They are sloped outwards at an angle of about 30 deg. and fitted to each side of the deck at its forward end.

Finishing the Run

A pilot cannot relax until he has finished his run and come to rest. It is often at the end of the run that dangerous swerves develop. Few shore-going pilots can say that they have never ground-looped (i.e., made a flat uncontrolled, complete turn on the ground upon landing). It is thought-provoking to recall that a ground loop on the deck means a certain crash into the island or the palisades or going over the side and sometimes, in extreme cases, a combination of all three.

The various carriers have different characteristics owing to the effect on the airflow of the profile of the deck and whether the ship be a flush deck or an "island" type. The advocates of the former type claim that under normal conditions there is nothing to choose between the two types of carrier, but that when the wind is unsteady in direction, or when the ship is rolling, the flush deck has a great advantage. The "island" enthusiasts contend that with this type of carrier landing is not interfered with by the emission of hot gases and smoke and, further, that the island gives the pilot a definite guide to height when making an approach to land.

In bad weather the ship may pitch considerably, the stern often rising and falling through a height of 30 or 40 feet. Rolling of the ship also makes deck landing more difficult. Their excessive weight (understood to be 3-4 per cent. of the ship's displacement) and the space occupied rules out gyro stabilisers. Though landing operations have to be carried out head-to-wind, excessive rolling may occur due to a cross-wind swell.

With a heavily loaded machine some pilots advocate a high approach, but this means flying slowly near the stall in disturbed air, which may be a nerve-racking process.

The pilot's view when approaching the deck is of the utmost importance, and everything must be done to make it as good as possible. The seat must be capable of being easily raised when carrying out a landing. A long cowling from the nose of the machine to the windscreen must be avoided, as this will block out all view of the deck as the aircraft flattens out shortly before passing over the stern. A nose sloping steeply away from the pilot is most desirable. Usually, the smaller frontal area of the water-cooled engine provides a better view for the pilot. With an air-cooled engine care must be taken that the exhaust ring does not blank the view.

The tail-down attitude which many modern aircraft assume at low speeds affects the view very considerably. Any attempt to improve it by pushing the nose down immediately results in a considerable increase in speed. In those aircraft where the pilot is not seated in front of the wings, or where the front of the fuselage is of necessity long, the designer must aim at giving him as good a view as possible over the sides and reaching as near to the fore-and-aft line of the aircraft as possible.

Good control on elevator, rudder and ailerons at slow speed is essential so that the ship-plane may be kept on

"The aircraft to be flown-off are brought up on the lifts from the hangars below decks and are ranged up behind each other on the flight deck. Often two or more squadrons are so ranged up at the same time." Sharks and Baffins are seen in this striking photograph taken on board H.M.S. *Courageous*.

its course during the last stages of the approach and so that any tendency to swing may be instantly checked. A broad undercarriage assists stability when running on the deck. If the ship is rolling, difficulty may be experienced in keeping a straight path. Independent and easily operated brakes greatly increase directional control on the deck. Arrester gear, rather than brakes, is relied on to reduce the landing run.

After the ship-plane has landed-on it has to be taxied to the forward lift or manhandled backwards to the after one and taken rapidly down into the hangar. Robustness of construction is necessary to prevent the aircraft being rendered unserviceable owing to rough handling, as this may on occasions be done by inexperienced ratings. The wings must be capable of being folded easily and rapidly; this has often to be done whilst going down on the lift. The locking arrangements of the wings must be easily and quickly operable, preferably without mechanics having to climb up on the machine. To see a squadron of experienced pilots land-on and watch the rapidity with which a well-trained deck party handles the aircraft is both a joy and an education. By the time the lift is up after taking down the first machine the second one is over the stern and ready to come on. Everything is done at the double—and, be it remembered, in a wind of 25 knots or more.

"Accelerators" are fitted to several of our aircraft carriers. These are in the nature of fixed catapults, sunk to deck level, so that the ship-plane runs forward on its own wheels. They are mounted at the fore end of the flight deck and can be used to launch the aircraft when the ship is at anchor and there is little or no wind. Under such conditions, with a heavily loaded aircraft, a longer run than is available on the flight deck would be required.

Not only must the structure of the ship-plane be designed to withstand the accelerative force, but care must be taken that no part will foul the launching chassis either during launching or loading-on.

Arrester Gear

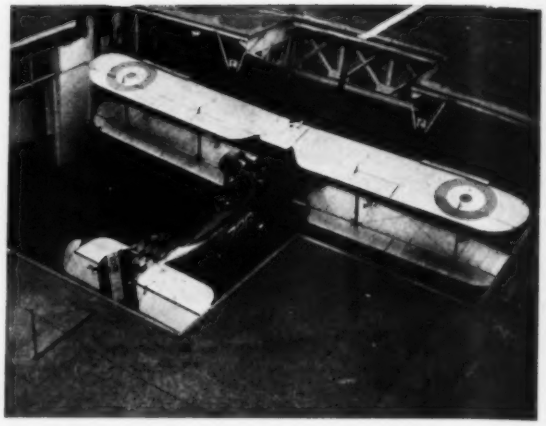
In order to reduce the run and bring the aircraft quickly to rest, use is made of arrester gear—a number of stout wires stretched across the deck at intervals. A specially designed hook attached to a triangular frame is trailed beneath the fuselage and engages with one of the wires, which is then allowed to run out under control of a braking apparatus beneath the deck. Care has to be taken in designing the gear that the hook readily engages and retains the wire. It is essential that bouncing should not occur, otherwise the hook may miss all the wires. No means of preventing the hook picking up a second wire is necessary, as when the first wire is engaged the tail and the hook rise automatically out of the way of subsequent wires.

Sufficient clearance must, of course, be given for the airscrew to miss the wires.

The arrester hook must be so positioned as to avoid risk of the aircraft nosing over or the tail rising excessively when a deck wire has been engaged, for the tail wheel dropping violently from a height of several feet on to the steel deck throws a severe strain on the fuselage. All controls for the arrester gear must be within easy reach of the pilot and, preferably, on the port side, adjacent to the throttle, so that they can be operated without changing hands.

The undercarriage of a ship-based aeroplane needs to be of robust construction and the oleo must be designed to eliminate bounce. In rough weather it often happens that just as the machine is about to touch down the deck will fall away from it. The aircraft is then left for an instant hanging in the air with little, if any, flying speed. Naturally, a heavy landing results. Of course, just as frequently the pilot will find the deck rise to meet him, and again the undercarriage is punished.

Owing to the special duties which they are called upon to perform, the equipment of carrier-borne aircraft is much more extensive than that of land types. This is largely due to the combination of duties, and considerable ingenuity is often necessary to find stowage for all the items of equipment called for and so dispose them that they are readily accessible.



"The designer is faced at the outset with restrictions with regard to span, width, length and height . . . so that the machine may be moved on to the lifts for transit between flight deck and hangars." A Fairey III F—an earlier type of Fleet Air Arm Machine—on the lift, with the crew getting into their cockpits.

Cockpit layout needs careful consideration; as much gear as possible has to be made automatic, for the pilot has more than a shore-based pilot to think about watching signals, identifying surface craft, etc.

This problem of the disposition of equipment is perhaps most acute in the case of the torpedo-bomber-spotter-reconnaissance types, where a crew of three is carried—pilot, navigator, and W/T operator-cum-gunner. As any one of these four duties may have to be carried out, stowage has to be found for such items as chartboard, bearing compasses, navigation instruments, code books, sea markers, smoke floats, flame floats, light filters, etc. Aldis signalling lamp, range finders, marine distress signals; few of these things are required on land-going types. One interesting detail is that the air-speed indicator must be graduated in knots instead of m.p.h.

The Navigator's Log

The accommodation for the navigator needs much careful consideration, for he has the difficult task of keeping an accurate reckoning of the ship-plane's position during the patrol and getting back to the carrier after a lapse of several hours, during which time the ship may have changed her position very considerably. A cramped position and a draughty cockpit are not conducive to accurate navigation. Ample space must be provided for the navigator to work on his chart-board; his instruments must be within easy reach; a clear arc on each side and as far astern and ahead as possible must be provided for his bearing compass; smoke floats and sea-markers must be within easy reach for use when required.

A good view must be provided for spotting for the gunfire of his own ships. Provision has also to be made for carrying out bombing and torpedo attacks and the necessary bomb and torpedo sights and releases fitted.

The rear gunner generally carries out the duties of wireless operator. His wireless gear must be so installed that he can keep a good look-out when operating his apparatus and be able to get into action quickly with his gun when required. If he be subjected to an icy blast for hours on end his efficiency will suffer. Consequently, care must be taken to give him ample protection. In fighter-reconnaissance or fighter-dive-bomber types the navigator has the rear defence of the aircraft added to his other duties.

Whilst the ship is at sea the machines have to be lashed down to eyebolts in the deck of the hangars to prevent movement and consequent damage during bad weather

when the ship may be rolling and pitching very considerably. Should any machine break loose under such conditions, it would not only sustain considerable damage but also damage other aircraft in the proximity. The havoc caused by a number of machines milling round can be imagined. Furthermore, considerable danger would be incurred to any personnel who might attempt to secure the breakaways. To guard against this contingency, attachment points must be provided on the undercarriage and on the front and rear of the fuselage.

Accidents happen even in the best-regulated ships, and the most experienced pilot may go over the side some time. In providing means for rapid egress of the crew, the fact must not be forgotten that the machine is as likely to fall into the sea upside down as right way up. The designer is faced with a very difficult problem in dealing with machines with enclosed cockpits. Flotation gear is, of course, essential both for such accidents as the above and also in the event of a forced landing. If the machine be forced down in the sea at a distance from a ship, the crew will have little chance of rescue unless the aircraft will remain afloat for a prolonged period. Sufficient buoyancy must be provided to cover this contingency. The action of the waves on a floating aeroplane must not be lost sight of, as this in time may cause leakage and consequent loss of buoyancy. Damage may also be sustained when striking the water, and an ample reserve of buoyancy must be provided.

Against such contingencies, buoyancy may be obtained by: (*a*) Internal air bags—though it is often difficult to find space for sufficient of these; (*b*) by external air bags inflated with CO_2; (*c*) by a large automatically inflated dinghy attached to the lifting sling; (*d*) or by watertight compartments in a monocoque fuselage.

An emergency dinghy must be provided for the use of the crew in the event of the machine sinking through loss of buoyancy. It must be remembered that a floating aeroplane is much more easily seen by searching air or surface craft than a dinghy, and as much of it as possible should remain above the surface.

Through bad judgment or adverse conditions the shipplane may turn over on its back when alighting in the sea; this is mainly due to the drag of the wheels when striking the water. To overcome this trouble, jettisoning the undercarriage has been tried. Retractable undercarriages should overcome the difficulty to a great extent without the loss of buoyancy resulting from dropping the wheels with their inflated tyres.

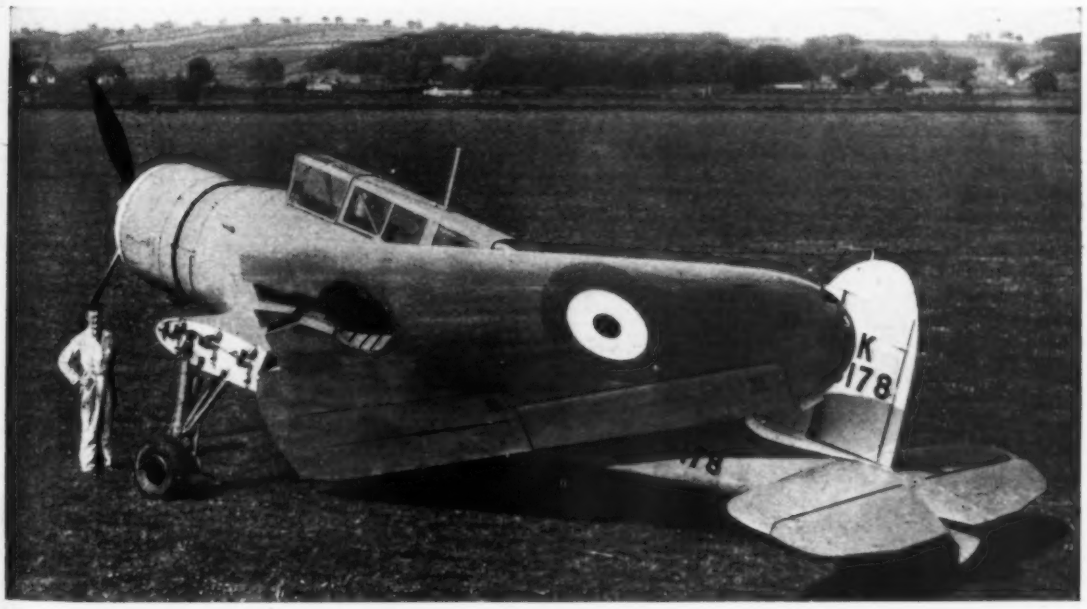
Jettisoning the petrol, and thereby getting rid of its weight, appears attractive but has several disadvantages. The fuel must be released before the aircraft reaches the water; it is difficult to make a valve which can not only be opened quickly but be closed quickly and still remain watertight; and there is risk of the crew being gassed by the fumes. If the petrol be pumped out of the tank after a forced landing, the sea surrounding the aircraft is a vast pool of petrol (200 or 300 gallons will cover quite a large area), which will probably drift with the aircraft and very likely gas the crew.

Corrosion Defence

Aircraft for use with the Fleet are particularly prone to corrosion. Even if they are not used as seaplanes they are constantly in a salt-laden atmosphere, whether they be actually embarked in an aircraft carrier or stationed at a shore base. Special protective measures must be taken to prevent corrosion taking place. Light alloys must be anodically treated; steel must be protected by plating with chromium, zinc or similar metals; precautions must be taken to insulate by means of marine glue or other approved compounds any dissimilar metals in contact. Stainless steel and duralumin in contact will quickly result in corrosion of the steel and rapid disappearance of the duralumin.

Ease of repair and maintenance is of importance as the workshop accommodation and storage space for spares is of necessity very limited in a carrier. The ship may be operating hundreds of miles away from a base and the personnel thrown entirely on their own resources for keeping their aircraft serviceable. Unserviceable machines in the hangars restrict the handling of the serviceable ones and all-important time is wasted.

These, then, are the main things that the designer of an efficient Fleet Air Arm machine must keep constantly in mind. The writer will feel that he has not failed if he has at least succeeded in inducing mild surprise in *Flight* readers unacquainted with the technical considerations of this interesting subject.



In a machine such as the new Blackburn fleet-fighter dive-bomber, seen here with one wing folded, high performance must not entail the sacrifice of load-carrying ability or practical folding and handling arrangements. (*Flight* photograph.)

A GUIDE to the R.A.F. DISPLAY

Some Programme and Admission Details

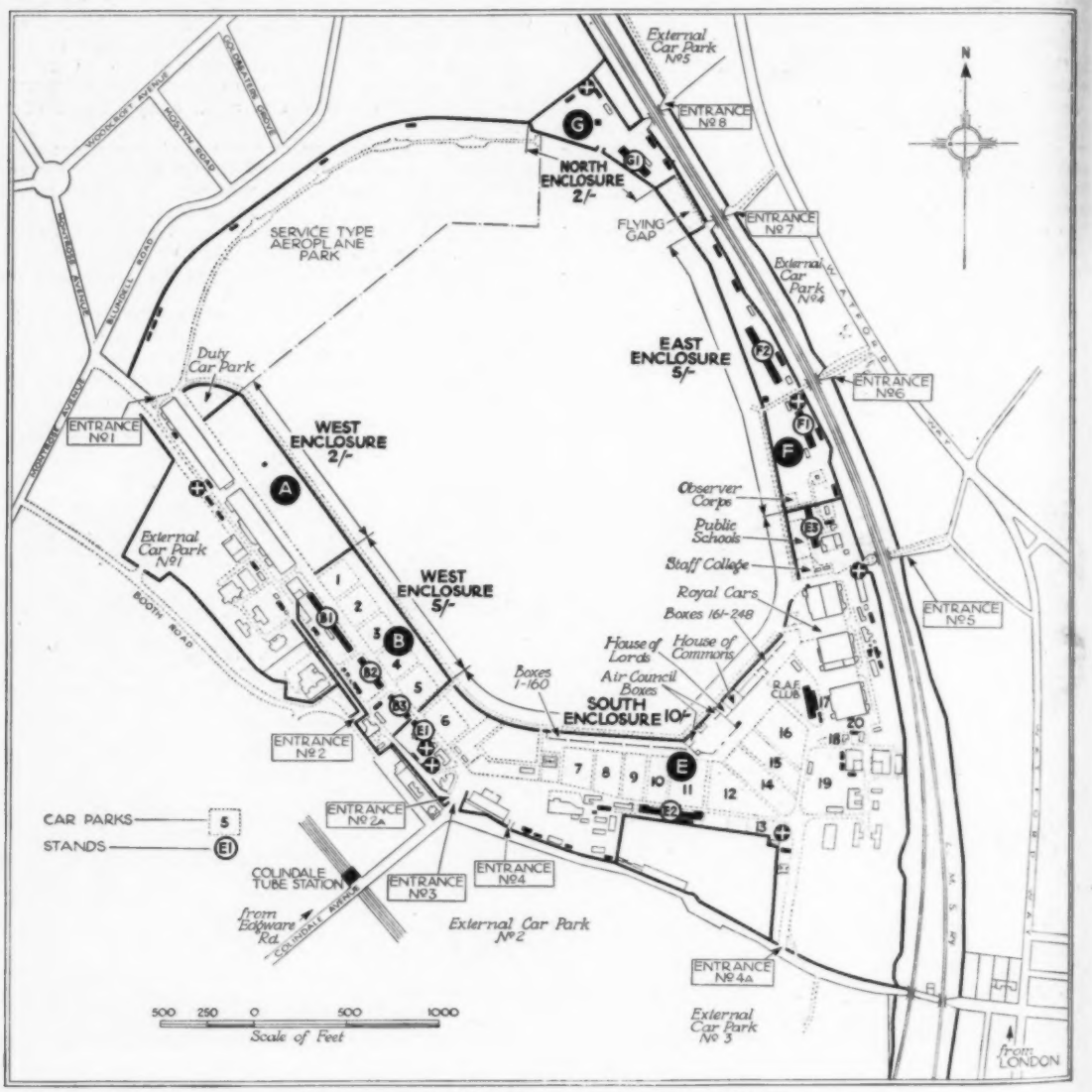
UNDOUBTEDLY the most spectacular item at next Saturday's Royal Air Force Display will be the massed fly-past by nearly 250 aircraft, consisting of a squadron of Harrows, nine squadrons of Hinds, five of Ansons, and ten of Gauntlets.

This is not the first time that a fly-past has figured in the Hendon programme, but nothing on this scale has been approached. Other items that should be of outstanding interest include a dive bombing competition between machines of each Home Command and also that popular "annual," the set-piece, which this year represents an attack on a harbour.

A novelty will be "big-game shooting" by a Monospar and the antique "Horace" Farman, and other items will include aerobatics (flight and individual), air gunnery, an attack on two kite balloons, a low-flying attack, low bombing, smoke patterns, instructor-and-pupil, and a landing competition. Altogether there are twenty items in the programme. The main programme begins at 3 p.m., preliminary events starting at 12.30.

The map below shows the layout of the entrances and enclosures, admission to which costs 10s., 5s., or 2s., while cars are admitted to the 10s., and 5s. enclosures for 10s. and 5s. respectively; motor cycles are 2s. to either. Tickets for the 10s. and 5s. enclosures, and for reserved grandstand seats (3s. and 2s. 6d. extra in 10s. enclosure and 2s. 6d. in the 5s. and 2s. enclosure), may be purchased in advance from the Display Secretary, R.A.F. Station, Hendon (Colindale 8242), from any R.A.F. station, from the Secretary, R.A.F. Benevolent Fund, 7, Iddesleigh House, Caxton Street, Westminster, or from the usual ticket agencies. All profits go to Royal Air Force charities.

The nearest stations are Colindale (Underground), Mill Hill (L.M.S.), and The Hale (L.N.E.R.), while a number of bus routes pass close to the aerodrome. The motorist will find the routes specially signposted over a large area. Traffic-handling plans are being revised, and the congestion of previous years should be avoided.



The arrangement of the enclosures and car parks at Hendon

COMMERCIAL AVIATION

CIVIL KESTRELS: These two South African Airways' Junkers Ju.86s, seen flying near Dessau, are fitted with fully supercharged Kestrel XVIs, and should by now have reached Johannesburg on their delivery flight.

THE WEEK AT CROYDON

Thunderstorms : Too True : Ambulance : Breakfast Food : Pioneers and Others

AS I remarked last week, thunderstorms are to be treated with respect. Nothing is to be gained, except an uncomfortable discharge of sparks from the tips of the ears, by flying merrily into dense masses of clouds. Experienced air-line pilots distinguish between what is best avoided and what need not cause another terminus to be sought.

On Friday last, for example, there were pretty bright blue lightning flashes and lots of thunder as real seeming and as awe-inspiring as the synthetic sort the B.B.C. produces with the tea-tray. (They say, by the way, that this highly specialised form of music is made by a retired air vice marshal who recently joined the other admirals and generals at Broadcasting House, he having special experience of the skies, as you might say.) Anyway, during the storm on Saturday evening Imperials, D.L.H., British Airways and K.L.M. all operated in and out of Croydon as usual, the last inward flight being the K.L.M. midnight arrival, which came along at 23.56, which, in these precise days, is nearly as bad as being the same number of minutes late.

Stories one immediately characterises as too good to be true are often merely too true to be credible. Here is a true one produced last week. One of the most senior Imperial pilots, immaculately uniformed and with an enviable chest of medals, happened to be behind the company's counter in the Main Hall when an elderly lady appeared. "Can I be of any assistance, madam?" asked the captain. "Yes," said she, producing a leather purse, "I want a cheese sandwich, please." Those, by the way, who write articles describing "the worst moment of my twenty years' flying" should remember this incident when writing this particular captain "up." Anyway, the explanation is the beautifully simple one that on the I.A.L. counter is one of those attractive menu cards of what may be had on board the "Silver Wing" service to Paris.

The flying ambulance which recently went to Budapest has returned to Croydon in triumph with a magnificent silver cup won in the teeth of international competition for the best civil aircraft converted for ambulance purposes. Col. E. M. Cowell, leader of the British Red Cross contingent, returned with the machine and made a stirring speech in which he regretted that air ambulances could not be sent to Spain because they could be converted to military purposes. I venture to suggest that if you can win silver cups for converting from civil to ambulance purposes you might win a laurel wreath for converting from ambulance to military purposes.

I hear that Imperial Airways have undertaken to supply British visitors at the Paris Exhibition with genuine British breakfast foods and afternoon-tea delicacies. From another source comes news that special daily consignments of Scandinavian delicacies are to be flown to Paris daily for the appropriate nationals. Many an Englishman who has gone to France to avoid the British breakfast will be saddened by this news.

Coronation medals, awarded to Captains Youell and O. P. Jones, amongst senior Imperial pilots, and to Capt. Percy, a younger captain, have now appeared, and the very attractive red, white and blue ribbon is being worn.

Some excitement was caused last week by an Air France Wibault, the brakes of which failed when taxying to the tarmac and which rushed violently down a steep place to the sheds and trampled, rogue-elephant fashion, upon a poor little Moth belonging to Surrey Flying Services. Eye-witnesses say that the pilot did everything possible in the (very trying) circumstances.

I see that someone has been writing to say that pioneer

flights are of immense importance to future air-line establishment and that the commercial people must accept this as true, little though they may like it. It is easy to understand the pioneer flight, to realise the motives behind most of them, and to collect the extremely minute data of any commercial value. It is not so easy, on the other hand, to comprehend the organisation needed to operate regularly over the same stretch of country. A quotation from *The Times* (about something quite different) seems apt in connection with many of these pioneer flights: "There can be no doubt that they will get there in the end. It would be agreeable to hail this outcome as a triumph for something or other over something else, but the principles involved are not very clearly defined and the whole matter is of no great importance to anybody." What IS of importance to everybody is to operate proper passenger and mail services with clockwork regularity.

Capt. Fry, well known at Croydon as a "traffic" expert, recently joined North Eastern Airways and has his hands full at present with the North of England activities of the company. Incidentally, N.E.A. will make a number of connections with K.L.M. in the north when that company starts the Liverpool-Doncaster-Amsterdam run again on July 1.

A. VIATOR.

More Navigation

WITHIN a week or two earnest air navigators will have yet another book to assist them in their researches. The McGraw-Hill people are publishing a British Empire edition of Weems' *Air Navigation*, a most thorough work covering some 500 pages

'Ware Cardington

FOR the benefit of those pilots who did not see, or who have forgotten, *Notice to Airmen No.* 32 of this year, it may be reiterated that balloons are being flown in the Cardington

Here are some of them.

(Bedford) area up to an altitude of 20,000ft. The cables are not marked in any way and machines should not approach within four miles of the station. It is unpleasant to have one's wings suddenly and unaccountably cut off.

On the Threshold

DURING the early part of next month either *Cambria* or *Caledonia* will leave the Shannon on its first Atlantic experiment. She will be commanded by Capt. A. S. Wilcockson, and on the same day it is expected that a Pan-American Sikorsky S.42B. will be leaving to make the eastward crossing.

Last Friday the Imperial Airways' shareholders formally approved a resolution that the capital should be increased to £5,000,000 in order to be ready for what Sir George Beharrell, in the absence of Sir Eric Geddes, called the "new era."

Making a Start

THE first section of Canada's long-awaited transcontinental airway is expected to be opened some time after July 15, when three Lockheed Electras are to be delivered for the Winnipeg-Vancouver run. Four more machines, it is reported, will be delivered early next year.

Full of hope, perhaps, that the transcontinental service is really on its way, private interests have formed a number of new companies. 'Skyways, Ltd., is due to operate a service from Toronto to Winnipeg, while another service is being started between Montreal and the Rouyn, northern Quebec mining camps; and Northern Flights, the Ontario division of Skylines Air Transport Express, has started operations from Toronto to the northern mining camps. A new air mail service from Edmonton to Whitehorse, Yukon, was expected to be put into operation on July 5 by United Air Services.

Meanwhile, it appears that the rest of the transcontinental airway will not be in action until next year at the earliest.

Sixteen Years of A.B.A.

DURING last year, the sixteenth of the company's activities, A.B. Aerotransport carried 23,649 passengers and 1,172,649 kg. of mail and freight on its twelve daylight and three night mail runs. Many of the former were of a seasonal nature, all-the-year-round services being those between Malmö and Amsterdam and Malmö and Berlin. Several of the others will no doubt become winter and summer service in due course, and two of the night mail runs were made through last winter. The fleet was increased by the addition of five Ju.52s (Wasp engines) and a Douglas D.C.3 is on order.

Australia—New Guinea

ONE of the tenders for an Australia-New Guinea service, which were called for early this year, has now been accepted. This, put in by W. R. Carpenter and Co., Ltd., the New Guinea operators, is one of those which were worked out on a D.H.86B basis, and three of these machines have been ordered by them.

It may be remembered that the conditions called for a multi-engined machine with a cruising speed of 140 m.p.h. or more and a range of 500 miles against a 30 m.p.h. headwind. Furthermore, it had to be capable of maintaining level flight at 5,000ft. with one engine out, and carry a minimum load of 1,400 lb., including six passengers. The contract is for five years' operation of a weekly return service from Sydney, *via* Brisbane, Rockhampton, Townsville, Cairns, Cooktown, Thursday Island and Wau to either Salamaua or Rabaul.

The 86Bs which are on order for the service will be ten-seaters, and the special equipment includes metal airscrews, bonding and screening,, Sperry horizon and gyro and full dual control.

D.L.H.'s New Floating Base

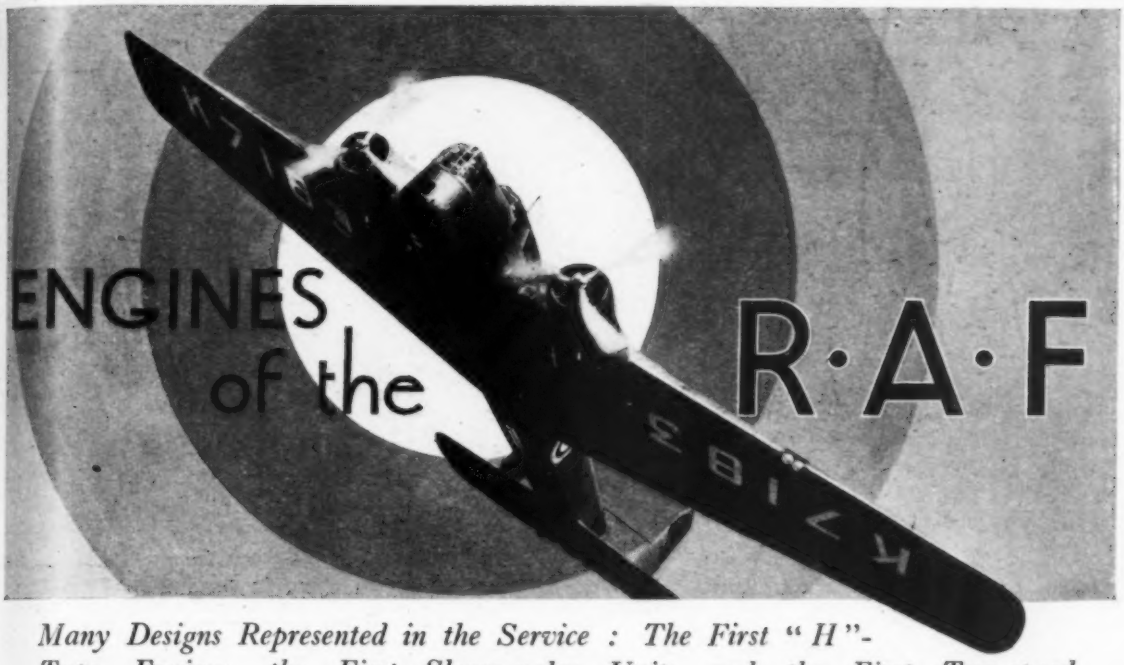
LARGER than, and an advance in every way on, the older ships used by the German Lufthansa on the ocean routes, the new motor ship *Friesenland*, of which the company has recently taken delivery, is intended for the North Atlantic service, while the previous ship, the much smaller *Ostland*, is to serve the South Atlantic, and will be stationed in the mouth of the River Gambia.

The new vessel has, like the *Ostland*, been built by the Howaldt works, in Kiel, and is a diesel-engined craft of 6,500 tons (metric) driven by two MAN engines of 2,500 b.h.p. each. The *Friesenland* has a length of 455ft. 3in., a beam of 54ft., and a draught of 19ft. 8in. The speed is approximately 16 knots. A very complete equipment is carried, including derrick and lifting gear, workshops, wireless, and, of course, tankage not only for the vessels own fuel, but for the aircraft which she is to serve.

The catapult fitted is of Heinkel manufacture and is one of the most powerful hitherto built, being capable of launching aircraft up to a gross weight of 17,000 kg. (37,400 lb.). As in the previous ships the aircraft are catapulted off over the stern and an extension aft of the starting rails permits of carrying a second machine in readiness, should this be desired. Turntables and rails make it possible to handle even larger machines with ease on deck.

As the intention is that the *Friesenland* should be stationed at the Azores, it is very necessary that she should be completely self-contained in the matter of repair facilities, no shore workshops being available within hundreds of miles. Her workshop is, therefore, remarkably well equipped, and she will be able to carry out even large repairs to both machines and engines.

In view of the fact that the crew will need to spend long periods on board, the *Friesenland* is provided with large recreation rooms, a gymnasium, a lounge with loud speakers for listening to wireless programmes, and a small, but carefully stocked library.

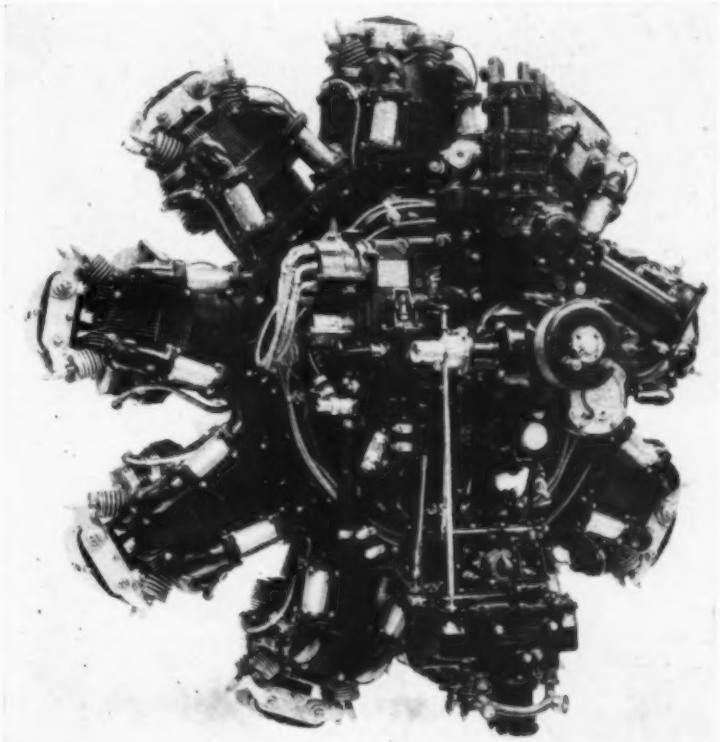


Many Designs Represented in the Service : The First "H"-Type Engines, the First Sleeve-valve Units and the First Two-speed Superchargers Supplied to the R.A.F.

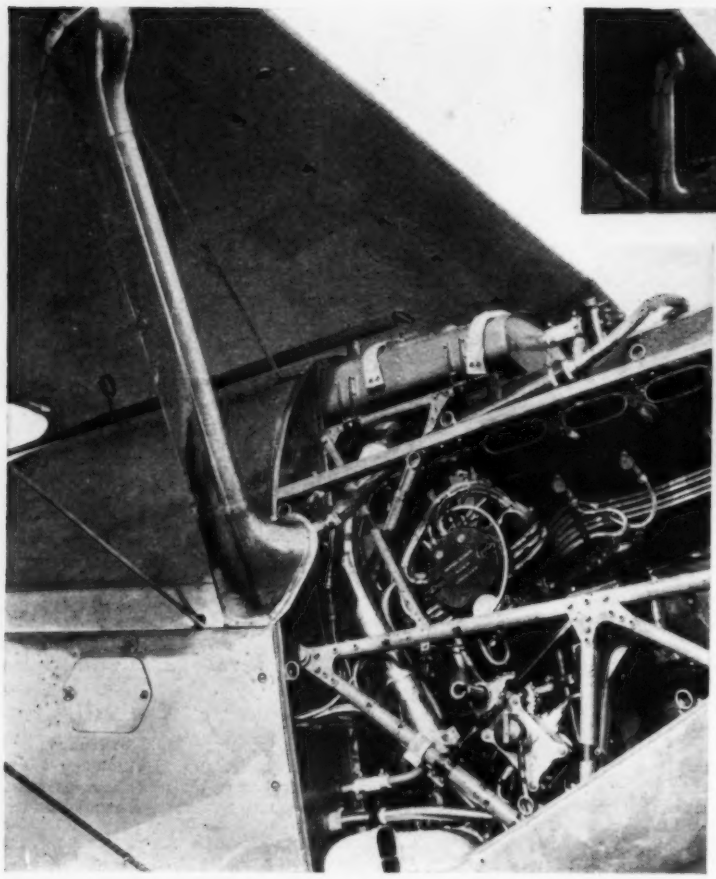
AS the lines of military aeroplanes are swept ever cleaner in deference to the gods of speed and efficiency, so it seems that an added burden of accessories is placed on the power unit for each increment of drag eliminated for fear its load shall grow too light. Casting the mind's eye back a dozen years the number of auxiliary drives for one engine totalled, at the most, six, including two magnetos and two camshafts; on the latest engines one may find, all as normal fitments, three oil pumps; two petrol pumps; water pumps; gun gear; two or even four camshaft drives; magnetos; generator; hand and electric starters or gas starter distributor; one, two, or three compressors; hydraulic pump; v.p. airscrew mechanism; tachometer; and one or two spare drives.

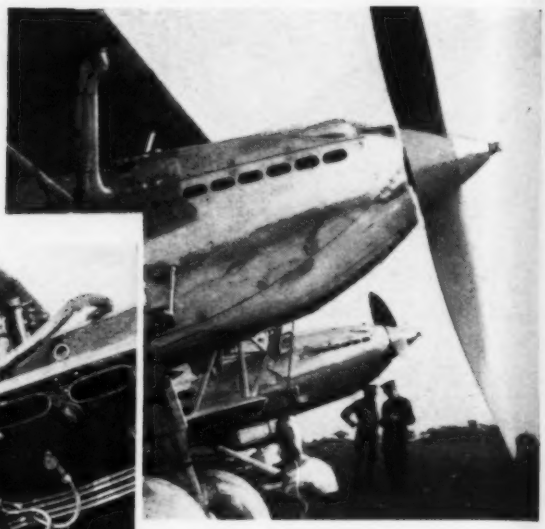
The majority of Service engines are now fully or moderately supercharged, and two-speed superchargers are now being launched on production scale. The trend is towards full supercharging for all types except flying boats and army co-operation machines. The operational altitudes in these cases are fairly low (in the neighbourhood of 5,000ft.), and good take-off and initial climb are most important.

With the introduction of automatic boost controls, the pilot was spared the job of watching boost gauges at take-off or high speed to safeguard his engine. Now the addition to several types of an automatic mixture control, which gives correct mixture strength for the power under any conditions from sea level to ceiling, will carry further the cause of economy and efficiency. The mixture lever controls one or two engines and is interlocked with the throttle. In the two positions correct mixture for



Behind Mercury's corona : There is no doubt that a full share of auxiliary driving is done by the Bristol Mercury VIII.





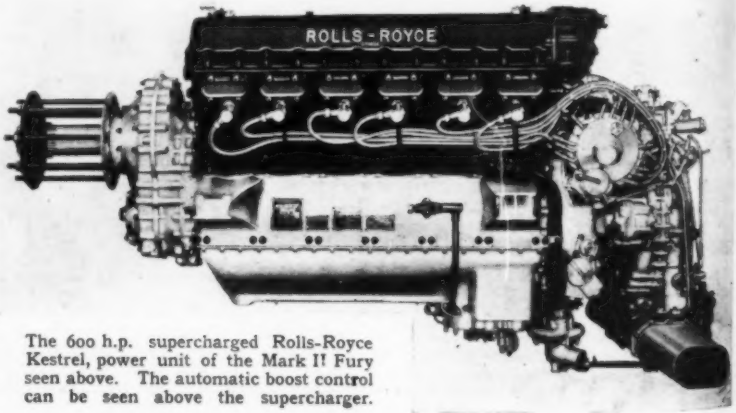
(Above) On this spatted Mark II Fury, with 600h.p. Kestrel engine, can be seen the almost flush exhaust stubs and the swelled strut indicating composite cooling. In the large photograph (left) details of this cooling system, including the pipe leading to the specially flaired strut, can be seen. The machine in the latter case is a Hawker Hind. (*Flight* photograph.)

either maximum power or maximum economy is provided.

Dealing with specific types, engines of the *Armstrong Siddeley* range are in use in very varied types. In the smallest category is the seven-cylinder Genet Major powering the Rota (Autogiro), one or two of which are in use in the Service; Reserve school Cadets also have this engine. Larger, but again having seven cylinders, is the Lynx IVC of 12.4 litres capacity found in the Avro Tutor. For training purposes the Saro Cloud is still in service with two-row ten-cylinder Serval engines. Moderately supercharged Cheetah IXs rated at an altitude of 6,000ft. are to be found in duplicate in the Avro Ansons, for general reconnaissance duties. The Airspeed Oxford is also to be powered by two Cheetah IXs driving de Havilland v.p. airscrews. The Fairey Gordon and Seal, both of which have flown many hundreds of hours, mount the fourteen-cylinder two-row Panther IIa. Blackburn Sharks were first equipped with Tiger IVs, but the later numbers, Shark IIs, have Tiger VIs. The Tiger series are two-row fourteen-cylinder radials with two inclined valves per cylinder and enclosed valve gear; the capacity is 32.7 litres. In large-scale production with v.p. equipment for civil and military purposes the Tiger IX is the interim equipment for the first Whitley bombers. Later Whitleys will have Tiger VIIIs. This engine, which is probably the first to go into production with a two-speed blower, is rated at 6,250ft. in low gear and 12,750ft. in high. The change of gear is made by oil under pressure, a two-way tap being fitted in the cockpit.

Service *Bristol* engines all fall in the larger category, and all are geared and have a single row of nine cylinders. The old Jupiter VII and VIII F. are leaving the Service as Bulldogs and Wapitis are replaced. Mercury VIs and IXs power Gauntlets and Gladiators respectively. The Mercury is very similar to, but nearly 4in. less in diameter than, the Pegasus. The bore of the two is the same, while the capacity is 24.8 litres as compared with 28.7. Both engines, in keeping with Bristol practice, have four partly enclosed valves per cylinder with automatic tappet compensation for expansion due to heat.

The prototype Westland Lysander had a Mercury IX supercharged to 13,000ft., but, this machine being an army co-operation type, the moderately supercharged

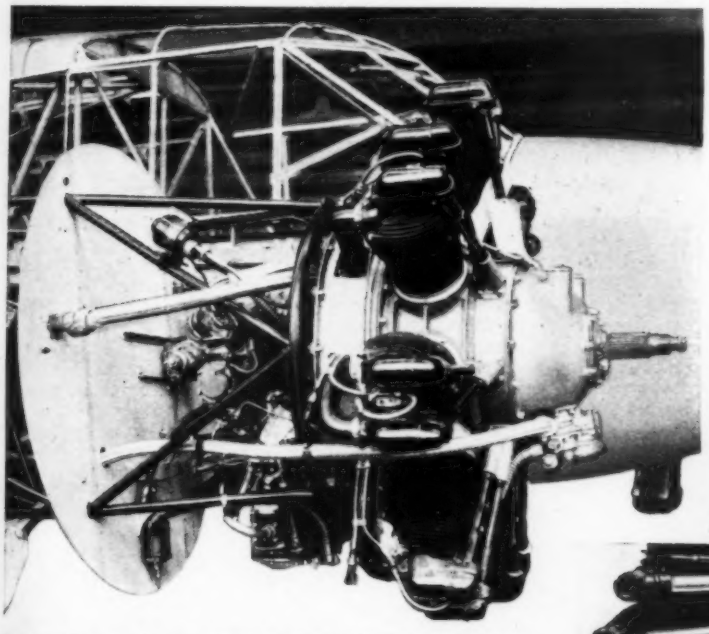


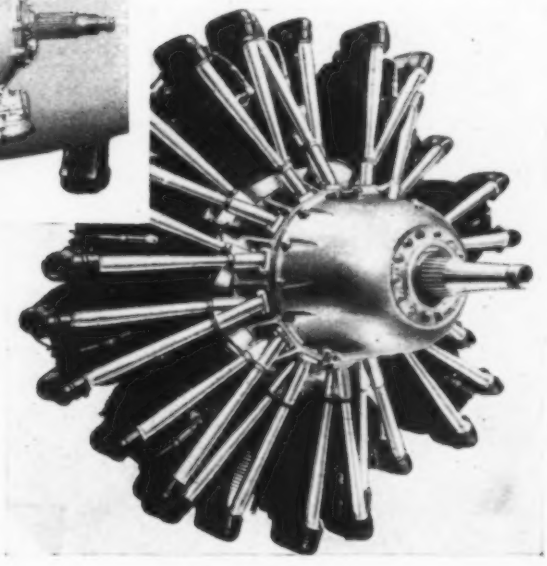
The 600 h.p. supercharged Rolls-Royce Kestrel, power unit of the Mark II Fury seen above. The automatic boost control can be seen above the supercharger.

In this handsome photograph of a Hector's nose, the countersunk exhaust manifolds, streamlined air cooling and air intake scoops, and oil radiator are characteristic features.

Mercury XII is now specified, and later on the Perseus, which is of the same capacity (24.8 litres) as the Mercury, though some 60 lb. heavier, may be substituted. The Perseus VIII, which gives its maximum power at 5,250ft., is now standard equipment for the Vildebeest IV, and is the first sleeve-valve engine in the world to go into service. Fellow to the Perseus, the smaller sleeve-valve Aquila in its supercharged A.E.3S. form is the power unit of the Venom single-seater fighter. Exceptionally clean design is a salient feature of the sleeve-valve engines.

Best known of the famous Bristol range, the Pegasus, is in service in moderately supercharged form as the IM, IIM, III, VI, and X, and fully supercharged as the XX. The I, II, and III are early types to be found in the Boulton Paul Overstrand (IIM), Saro London (III), and Fairey

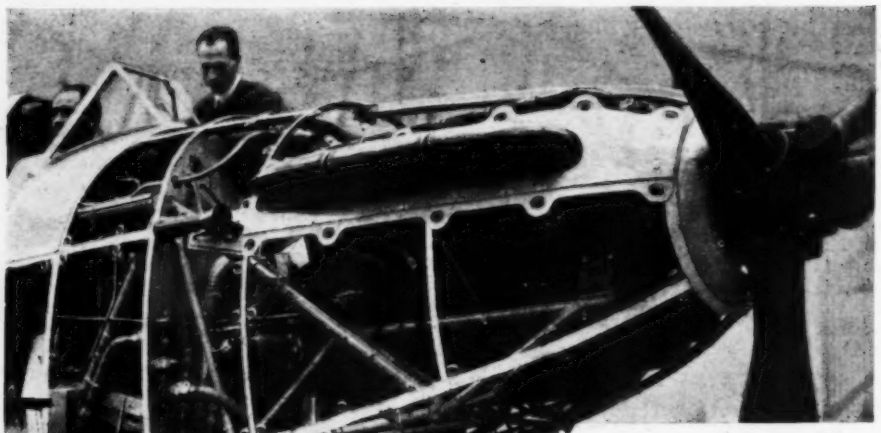


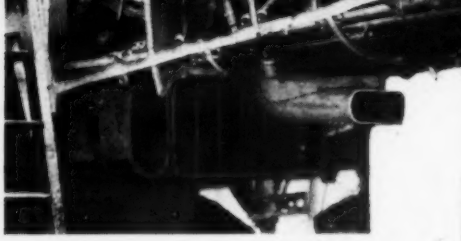


(Above) One of the seven-cylinder Armstrong Siddeley Cheetah IXs installed in an Avro Anson. The big brother of this little unit, the Tiger VIII (right) rated at 14,500ft., is the first production engine to be fitted with a two-speed supercharger.

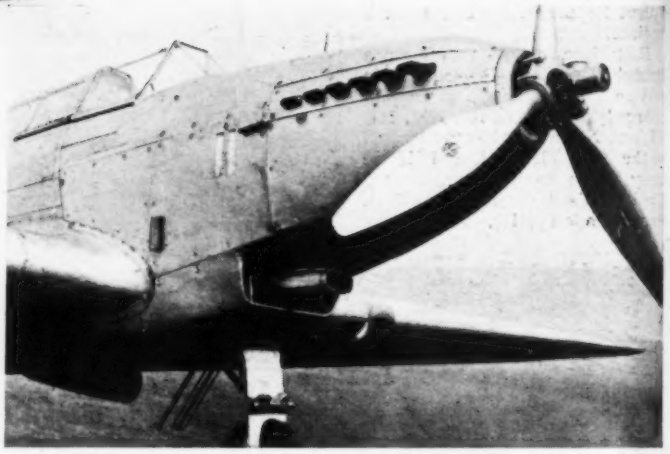
Swordfish (III). The Pegasus VI is a special engine for the pusher installation in the Supermarine Walrus amphibian. A pair of the later Pegasus Xs are mounted in the Supermarine Stranraer, the later model of Saro London, and also in the H.P. Harrow I, but the Harrow II has XXs. Long-chord cowling with controllable gills and single outlet, nose-type exhaust collector ring, and two-position D.H. v.p. airscrew are standard on the later Pegasus models, which have closer cylinder finning and a higher power rating on 87-octane fuel.

The two-crankshaft 24-cylinder air-cooled "H"-shaped *Napier* Dagger III engine is one of our most advanced Service engines. The number of small cylinders of this design allows extremely smooth running. The Hawker Hectors of No. 13 (AC) Squadron are the first to have Dagger IIIs. At full throttle as much as 49.7 h.p./litre has been taken





(Left) An uncowled Rolls-Royce Merlin engine in a production Fairey Battle reveals the down-facing carburettor in-take with its scoop, the separate radiators and details of mounting. In contrast, below, is the finished product faired and cowled. The latest type of exhaust manifold, shown in the first illustration, may be compared with the more familiar stubs seen below. (*Flight* photographs.)

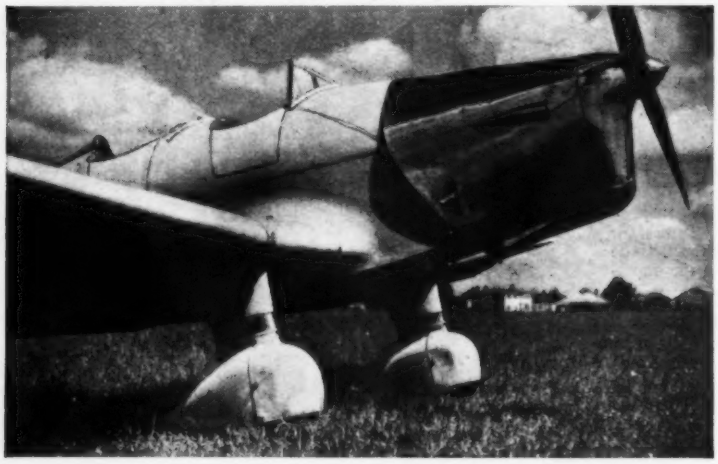


from a Dagger III. Many points of unusual interest are to be seen in the Dagger, in particular the self-adjusting tappets and streamlined scoop and baffling to give adequate and even cooling to all twenty-four cylinders.

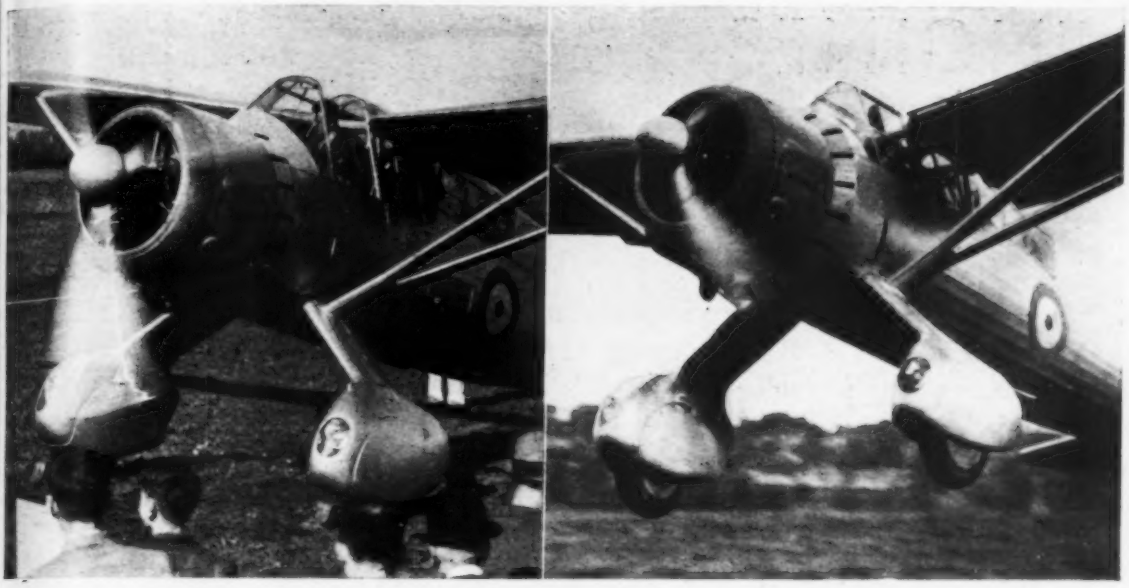
Known the world over as an engine of exceptional workmanship and also as the power unit of the Hawker range (Hart, Demon Fury, Audax, Osprey, Nimrod, Hind, etc.), the vee-twelve *Rolls-Royce* Kestrel is the only water-cooled engine in Squadron use now that the Blackburn Perths with three R.-R. Buzzard II M.S. engines are almost superseded. Available with 0.477, 0.553, or 0.632 to 1 reduction gear, the 21-litre Kestrel family, the IB (B indicates a 7 : 1 compression ratio), then the IIS and IIIMS and, later, V, VI, and normally aspirated X, have given thousands of hours' service and are now handing over to the Merlin in new machines. All the supercharged Kestrels are cleared for v.p. airscrew equipment and tested for composite cooling. For this cooling the adjustable radiator employed for a 600 h.p. engine is the same size as for the earlier engines, giving only 480 h.p. In level flight the compositely cooled engine is water-cooled entirely, but in climb a slight degree of boiling (steam cooling) occurs at a small pressure. A few of the more observant folk will have noticed a swelled starboard centre-section strut fairing on some Hawker types. This carries a pipe to the condenser—part of the steam cooling system—in the top centre section.

An unsupercharged Kestrel IB or X installation, as in the Audax, can be picked out by the two small air scoops on top of the cowling feeding the twin carburettors located between the cylinder banks.

The Rolls-Royce Merlin engine, designed for D.T.D. 230 (87-octane) fuel, has a 6 : 1 compression ratio and is of 27 litres capacity. A 0.477 reduction gear is fitted and v.p. airscrew equipment is specified except when installed in certain single-seater fighters such as the Spitfire or Hurricane, when the weight factor is of particular importance. Ethylene glycol is the cooling medium, and outlet temperatures vary from 110° to 130° C. as a maximum. A single streamlined air scoop differing a little in the shape and position according to aircraft deals with all cooling on Merlin installations in the Fairey Battle, Supermarine Spitfire, and Hawker Henly.



Under the shining "bonnet" of the Miles Magister is a De Havilland Gipsy Major engine.



An interesting comparison of open and closed cooling gills on the Westland Lysander with Bristol Mercury VIII engine is seen in these two photographs, taken immediately prior to take-off and just after take-off. (*Flight* photographs.)

In the last few years exhaust outlets for in-line engines have undergone a series of changes, examples of which can be seen in the Hawker series. For night flying and training duties long pipes are usually fitted with a view to reducing noise and damping flame. For two-seater aircraft with folding wings, the pipe is cranked downwards. For high-speed operation short stubs are used. The kidney-type manifolds superseded the various long shapes, and newer still are the recently developed "streamlined" manifolds seen on the installation of the Battle Merlin I and the Hector Dagger III.

Accepted as Service equipment the *De Havilland* Gipsy-Twelve, known as the Gipsyking I, is, so far, to power the Don I advanced trainer ordered off the drawing board. The Gipsyking I is an inverted, geared, and supercharged air-cooled vee-twelve unit. The Gipsy Major is fitted to the Miles Magister and the Gipsy Six, known as the Gipsy-queen I, will power the Miles Mentor trainer.

LEADING DATA FOR ENGINES IN SERVICE WITH THE R.A.F.

(These figures are not in all cases the latest manufacturers' ratings and do not represent their complete range of models.)

Maker's Name and Engine Type.	No. of Cyls.	Arrangement of Cyls.	Cooling Medium.	Capacity.	Rated Altitude.	Normal Engine Speed.	Normal Power.	Max. Altitude Power.	Take-off Power.	Weight.	Remarks.
ARMSTRONG SIDDELEY :				Litres.	ft.	r.p.m.	h.p.	h.p.	h.p.	lb.	
Genet Major I A ...	7	R	A	7.32	S.L.	2,200	150	165	150	327	—
Lynx IV C	7	R	A	12.39	S.L.	1,900	215	240	225	515	—
Cheetah IX	7	R	A	13.65	6,000	2,100	310	350	340	635	—
Serval I	10	2-R	A	17.7	S.L.	2,000	340	365	346	714	—
Panther II A	14	2-R	A	27.31	5,500	2,100	560	650	627	980	Geared fan "blower."
Tiger IV	14	2-R	A	32.7	4,500	2,150	720	792	730	1,103	—
Tiger VI	14	2-R	A	32.7	5,000	2,150	760	810	840	1,180	—
Tiger VIII	14	2-R	A	32.7	14,500	2,375	—	920	—	—	2-speed supercharger.
Tiger IX	14	2-R	A	32.7	6,250	2,375	805	804	880	1,220	—
BRISTOL :											
Jupiter VII F... ...	9	R	A	28.7	8,000	1,775	490	530	460	825	(F is series number.)
Jupiter VIII F ...	9	R	A	28.7	4,000	2,000	460	480	460	905	—
Mercury VIII, IX ...	9	R	A	24.8	13,000	2,650	825	840	730	980	Gear : VIII = .572, IX = .5 to 1.
Pegasus I M	9	R	A	28.7	4,000	2,000	555	615	600	995	(M = moderately supercharged.)
Pegasus II M	9	R	A	28.7	5,000	2,000	580	635	620	980	
Pegasus III	9	R	A	28.7	3,500	2,200	690	750	755	1,010	—
Pegasus X	9	R	A	28.7	4,000	2,250	915	850	960	1,005	—
Pegasus XX	9	R	A	28.7	9,000	2,250	820	925	830	1,015	—
Perseus VIII	9	R	A	24.8	5,000	2,200	670	810	700	1,040	Max. power at 5,250 ft.
DE HAVILLAND :											
Gipsy Major	6	I.L.	A	6.124	S.L.	2,100	120	130	130	300	—
Gipsy Queen I ...	6	I.L.	A	9.186	S.L.	2,100	185	200	200	468	(Service Gipsy-Six.)
Gipsy King I	12	I.V.	A	18 (approx.)	—	—	—	—	—	—	Max. power over 500 h.p.
NAPIER :											
Dagger III	24	H	A	16.8	3,500	3,500	725	805	755	1,305	Max. power at 4,000 r.p.m.
ROLLS-ROYCE :											
Kestrel I b	12	V	W	21.3	3,000	2,500	525	560	525	885	(b refers to 7 to 1 compression.)
Kestrel II MS	12	V	W	21.3	2,000	2,250	525	630	525	910	(MS = moderately supercharged.)
Kestrel II S	12	V	W	21.3	11,500	2,500	525	600	480	910	(S = supercharged.)
Kestrel V, VI	12	V	C	21.3	11,000	2,500	600	640	695	975	Gear : V = .553, VI = .477 to 1.
Kestrel VI (de-R) ...	12	V	C	21.3	11,000	2,500	505	625	550	975	(de-R = de-rated.)
Kestrel X	12	V	W	21.3	S.L.	2,500	585	630	585	885	—
Buzzard II MS ...	12	V	W	37	S.L.	2,000	825	955	845	1,540	Max. power at 2,300 r.p.m.
Merlin I, II	12	V	E.G.	27	12,000	—	990	1,050	—	1,318.5	—

A = Air. W = Water. C = Composite. E.G. = Ethylene glycol. R = Radial. 2-R = Two-row Radial. I = Inverted. L = In Line. V = Vee formation. H = "H" formation. S.L. = Sea Level.

ENGINES at HATFIELD

S.B.A.C. Show: Début of Advanced High-Powered Models: Two-speed Blowers: Figures for the Latest Bristols: The New Napier: 1,700 h.p. From an Alvis

IT is difficult to recall a more meritorious display of British aero engines than that to be seen at Hatfield next Monday and Tuesday. At least two high-powered engines will be making their first public appearance, and in several instances figures for new types have only just been released by the Air Ministry.

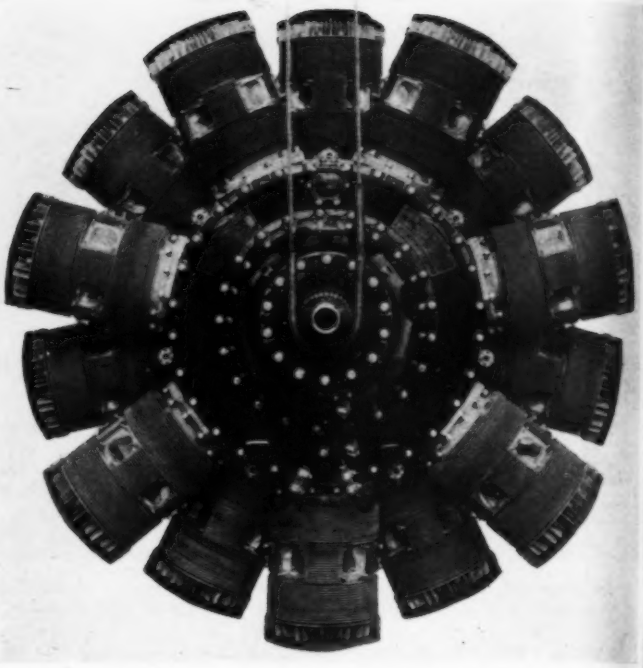
The units which go to make up this outstanding display are treated hereafter under the names of their manufacturers.

ALVIS.—The new Alvis two-row Alcides and Pelides Major engines will appear on Stand D, the former being an 18-cylinder model, while the latter is a 14-cylinder type. New and important features have lately been incorporated: more efficient cooling has been effected, the power-to-weight ratio is only a fraction above 1 lb. per h.p. and the small overall diameter and clean exterior design of the engines provide for simplified installation and more effective cowling.

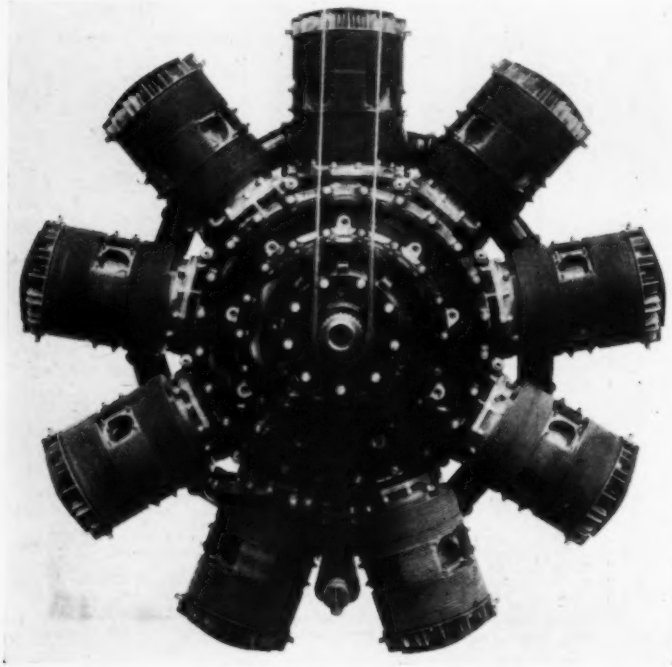
Both models are geared, but the Alcides on show will be moderately supercharged, whereas its companion is fully supercharged.

The leading characteristics of the Alcides are: bore, 5¾in.; stroke, 7.087in.; diameter, 55¼in.; net weight, 1,670 lb.; max. take-off r.p.m., 2,250; take-off power, 1,700 h.p.; international rated power, 1,650 h.p. Those of the Pelides Major are: bore, 5¾in.; stroke, 6¼in.; diameter, 52in.; net weight, 1,190 lb.; max. take-off r.p.m., 2,400; take-off power, 1,000 h.p.; international rated power, 1,000 h.p.

Makers: Alvis, Ltd., Holyhead Road, Coventry.



Of advanced conception and beautifully finished, the 1,150 h.p. fourteen-cylinder sleeve-valve Hercules is the newest of the Bristol engines.



ARMSTRONG SIDDELEY.—The *pièce de résistance* of the Armstrong Siddeley exhibit on Stand L will be the fourteen-cylinder two-row Tiger VIII, fitted with two-speed supercharger and variable-pitch airscrew. This new engine, which powers the latest models of Armstrong Whitworth Whitley heavy bombers, delivers 920 h.p. at 2,375 r.p.m. for take-off and 782 h.p. at 14,500ft. The Tiger VIII should be studied in conjunction with the working model of a two-speed supercharger. This is constructed on the epicyclic principal, the change of gear being effected by means of pressure oil passing through a two-way cock manually controlled by the pilot.

In addition to the Tiger VIII there will be the latest type of Cheetah which is known as the Series X. This seven-cylinder moderately supercharged air-cooled radial is equipped for the operation of a variable-pitch airscrew and delivers 373 h.p. for take-off. At 7,100ft. and 2,300 r.p.m. the output is 340 h.p. and at 7,600ft. and 2,425 r.p.m. the figure is 351 h.p. Also on show will be the Cheetah VA normally aspirated radial rated at 285 h.p. at 2,100 r.p.m. At maximum speed (2,400 r.p.m.) the power is 326 h.p.

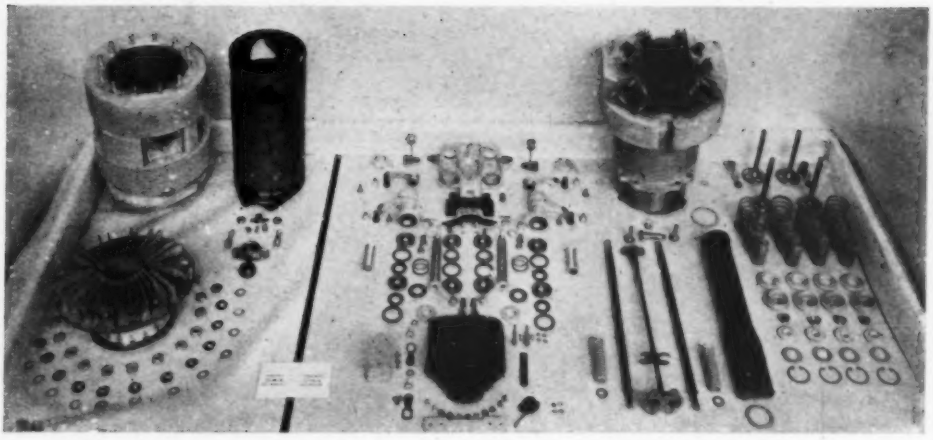
Makers: Armstrong Siddeley Motors, Ltd., Parkside, Coventry.

BRISTOL.—The latest medium-supercharged Mercury, a Pegasus with two-speed blower, the newest Perseus, and the Hercules will all figure in the Bristol exhibit on Stand J.

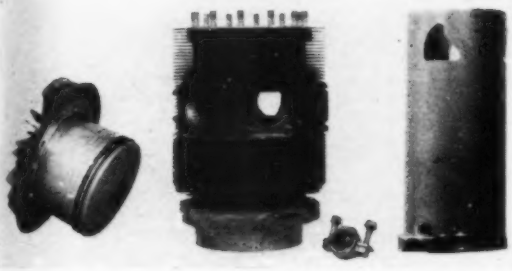
Known as the Mercury Series XI and XII, the new medium-supercharged Mercury engines have

Rated at 745 h.p. at 6,500ft. the 24.9-litre Perseus is a type destined for extensive military and civil service.

The parts of a poppet-valve cylinder assembly compared with those of one of the new Bristol sleeve-valve units.



The simple and robust construction of the components of a Bristol sleeve-valve cylinder are strikingly apparent in the view below.



completed their one hundred hours type tests with very gratifying results, the performance figures being considerably in excess of those promised to aircraft constructors. The Mercury XII will go into service in the R.A.F. as the power plant of the Westland Lysander.

The following are the official figures for the Mercury XI and XII: maximum take-off power, 830 h.p. at 2,650 r.p.m.; international rating, 790/820 h.p. at 2,400 r.p.m. at 3,500ft.; maximum power for all-out level flight (not more than five minutes), 890 h.p. at 2,750 r.p.m. at 6,000ft.

The Mercury has a bore and stroke of 5½in. x 6½in., giving a capacity of 1,500 cu. in. (24.9 litres). Its overall diameter is only 51½in., and its net weight 980 lb.

Designated the Pegasus XVIII, the new Bristol engine with the two-speed supercharger has recently passed its type test. Experimental work on a two-speed blower, with the object of combining the high take-off power of a medium-supercharged engine with the maximum performance at high altitudes by full supercharging, was commenced by the Bristol company early in 1934. After two years of research an hydraulically operated clutch was evolved and the supercharger was subjected to the severest possible trials, including 600 hours on test rigs.

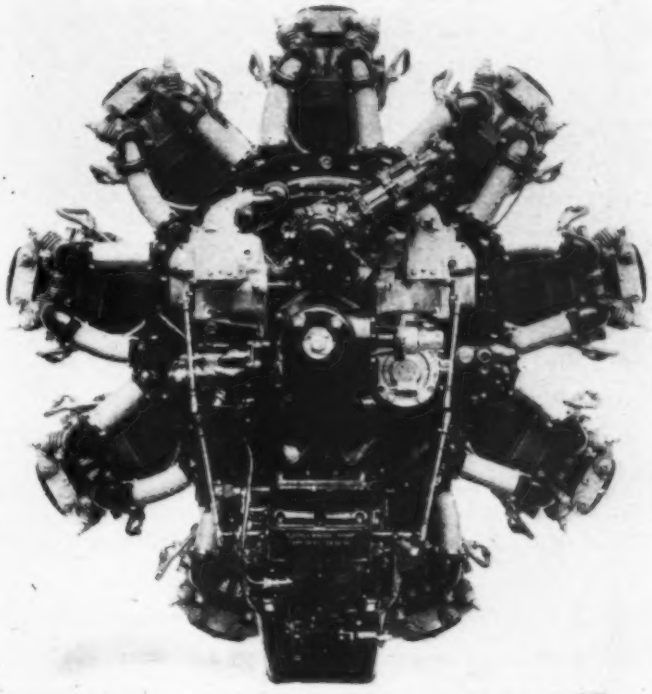
The following performance figures, using both medium and full supercharge ratios, have been released for publication:—

	Using Medium Supercharge ratio.	Using Full Supercharge ratio.
Maximum take-off power.	940/980 h.p. at 2,475 r.p.m.	—
International rating.	820/855 h.p. at 2,250 r.p.m. at 5,000ft.	765/800 h.p. at 2,250 r.p.m. at 15,500ft.
Maximum power for all-out level flight (not more than five minutes).	900/940 h.p. at 2,600 r.p.m. at 6,500ft.	860/900 h.p. at 2,600 r.p.m. at 17,750ft.

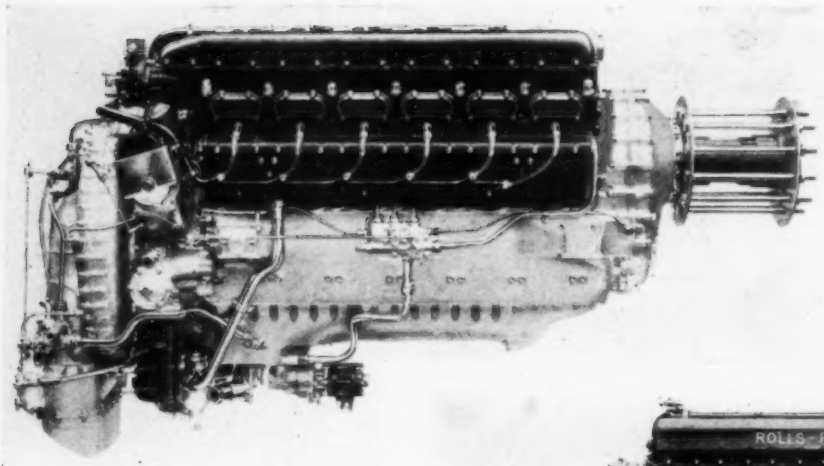
The various periods of maximum cruising, climbing, and high power were run with each supercharge ratio in turn, as well as a high-speed period using full supercharge, and complete cycles of gear changing were effected twice every hour. One hundred and ten changes were made in both ratios, and the endurance test report comments on the freedom from vibration or clutch slip at all speeds. The final power observations exceeded the initial figures in each case.

The Perseus and Hercules sleeve-valve engines will, of course, be of special interest, not only on account of their unique design, but because the Perseus is now undergoing Service tests in squadron use.

As long ago as 1926 the Bristol Aeroplane Company foresaw the enormously increased demand for power which is required to-day. It was considered that the air-cooled aero engine would maintain its lead in power for weight, but that it would eventually become imperative to surmount the speed and load limitations associated with overhead valves operated by push rods. Several engines with an overhead-camshaft arrangement were designed, and one type was built and tested, but the Bristol company, encouraged by the British Air Ministry, de-

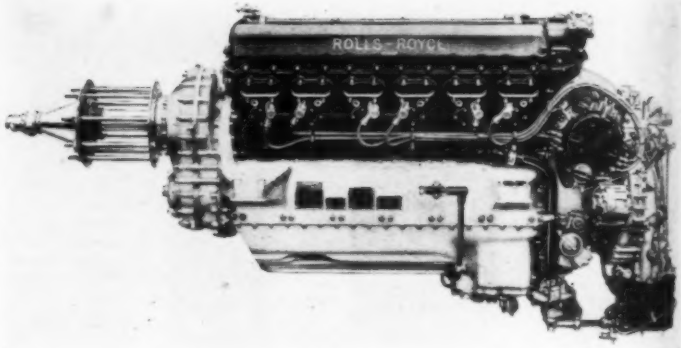


Fitted with a two-speed supercharger the new Bristol Pegasus XVIII gives 980 h.p. for take-off, 855 h.p. at 5,000ft. and 900 h.p. at 17,750ft.



On the left is the 990/1,050 h.p. fully supercharged Rolls-Royce Merlin, which will be shown at Hatfield fitted with one of the new Rotol air-screws.

The Rolls-Royce Kestrel XVI (below) has been ordered for military and civil use. It has been type-tested to drive a two-position variable-pitch airscrew.



veloped the single-sleeve valve system and adopted a long course of intensive research, including more than 20,000 hours single-cylinder test running.

A complete engine of 24.9 litres capacity was first built, and immediately showed great promise in its dynamometer performance. This became known as the Bristol Perseus sleeve-valve engine, and completed its trials, with outstanding success in 1933. A second type—a more compact, high-speed, radial, air-cooled, sleeve-valve engine, of about 15½ litres capacity, was subsequently produced. Known as the Bristol Aquila, it was first type-tested in 1934 with equally satisfactory results.

Over three thousand hours development testing on the dynamometer and a similar period in the air, including long overload periods and practical commercial testing by Imperial Airways, were successfully completed, and a squadron of the Royal Air Force is now equipped with Perseus-engined Vickers Vildebeest machines, with the object of thoroughly testing the sleeve-valve unit under Service conditions.

The main advantages of the sleeve-valve engine are both operational and technical. The former include the elimination of valve maintenance and top overhauls; exceptionally low fuel and oil consumptions (the latter decreasing with use); reduction of mechanical and exhaust noises, and a reduction of fire risk due to low exhaust ring temperature as a result of higher compression ratios and more even cylinder-head temperatures. Technical advantages include greater all-round thermal efficiency; a perfectly accurate reproduction of the designed valve diagram, without limited speed by a positive sliding motion; simplicity and a great reduction in the number of parts, while substantially higher compression and super-charge ratios may be used for a given fuel specification, which gives greater power and economy.

The Latest Perseus

A 100-hours' type test of the medium-supercharged Perseus 9-cylinder engine has been successfully completed at a considerably higher rating than hitherto, and the performance figures, just released for publication, are as follows: maximum take-off power, 785/815 h.p. at 2,650 r.p.m.; international rating, 715/745 h.p. at 2,400 r.p.m. at 6,500ft.; maximum power for all-out level flight (not more than five minutes), 860/890 h.p. at 2,750 r.p.m. at 7,000ft.

A similar engine, of the first Perseus production type, has also completed a highly satisfactory 200 hours' flight endurance test.

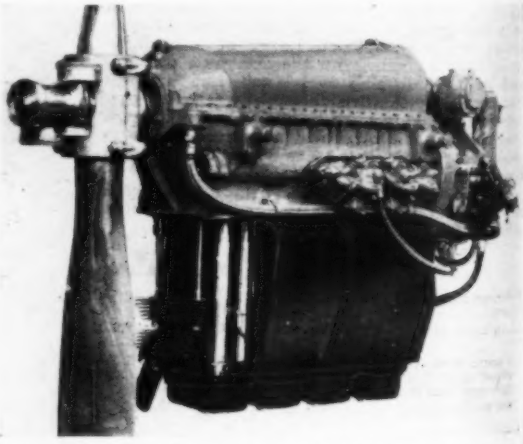
The Perseus has nine cylinders, with a bore and stroke of 5¾in. × 6½in. (146 mm. × 165 mm.), giving a cubic capacity of 1,520 cu. in. (24.9 litres).

Of particular interest, however, are the output figures from Britain's most powerful type-tested aero engine—the 14-cylinder double-row Bristol sleeve-valve unit known as the Hercules, which created such interest at the last Paris Show. This engine was designed in 1935 and was first tested early in 1936. The fourteen cylinders have the same bore and stroke as the Perseus, giving a total capacity of 2,360 cu. in., or 38.7 litres. The following performance figures, just released, are for the medium-supercharged version: maximum take-off power, 1,240/1,290 h.p. at 2,650 r.p.m.; international rating, 1,100/1,150 h.p. at 2,400 r.p.m. at 5,000ft.; maximum power for all-out level flight (not more than five minutes), 1,325/1,375 h.p. at 2,750 r.p.m. at 4,000ft.

Official restrictions prevent the publication of any further details concerning development testing, which is in active progress, but the Bristol Hercules engine will take a very important place in Service duties, especially in view of the impending adoption of 100 octane fuel, of which the sleeve-valve engine can take full advantage. This engine also marks a great advance in the plans for long-distance air transport, owing to its high power for relatively low bulk, weight and fuel consumption.

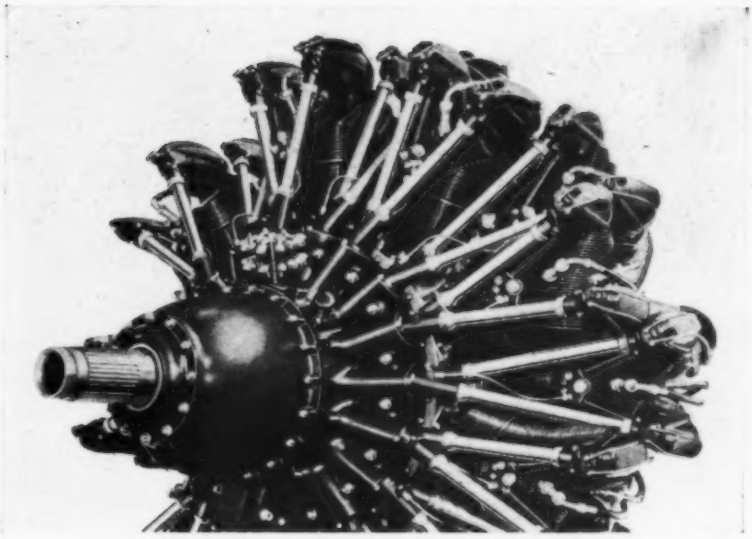
Makers: The Bristol Aeroplane Co., Ltd., Filton, Bristol.

CIRRUS.—Both the 75-85 h.p. Cirrus Minor and the 138-150 h.p. Cirrus Major units will be exhibited by the Cirrus Hermes Engineering Co., Ltd., on Stand M.



The De Havilland Gipsy Major Series II is shown fitted with a D.H. variable-pitch airscrew. It embodies a number of innovations as compared with the Series I Major.

The most powerful engine at Hatfield will be the eighteen-cylinder Alvis Alcides, which is claimed to deliver 1,700 h.p. for take-off.



The respective capacities of these engines are 3,605 c.c. and 6,330 c.c., and their weights 210 lb. (approx.) and 325 lb.

Both are air-cooled inverted four-cylinder in-line types and are characterised by their neat and compact appearance.

A particular point of interest is the type of cylinder used, this being designed to dispense with the usual long holding-down stud. It is machined from high-grade steel and located in the crankcase by spigots which are secured at their base by four short, stout bolts.

Makers: The Cirrus-Hermes Engineering Co., Ltd., Brough Aerodrome, E Yorks.

DE HAVILLAND.—The De Havilland Aircraft Co., Ltd., are arranging to display a selection of engines and controllable-pitch airscrews (see page 649) on Stand K.

The engines will comprise the Gipsy Major Series II, and the Gipsy Six Series II, both intended for fixed-pitch or variable-pitch airscrews. In addition there will be sub-assemblies of the Gipsy Six Series II to show some of the features in which it differs from the familiar Gipsy Six Series I. These sub-assemblies will include the following:—a cylinder-head assembly; piston and connecting rod assembly; the new crankshaft; a camshaft; a train of timing gears; the oil filters; and a cylinder.

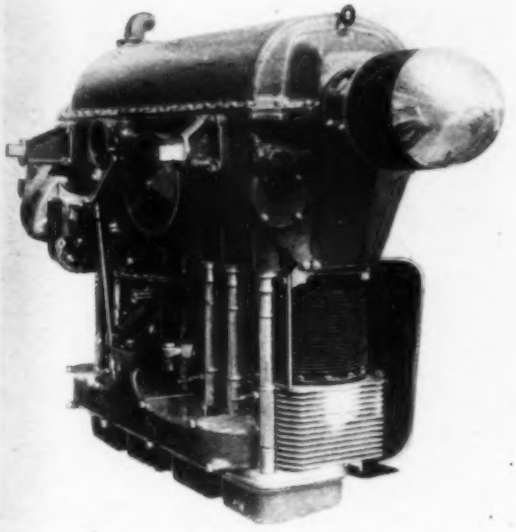
Makers: The De Havilland Aircraft Co., Ltd., Hatfield, Herts.

NAPIER.—Included in the Napier exhibit on Stand G will be a Dagger E.108 "H"-shaped 24-cylinder air-cooled engine. As this unit is still semi-secret full details and performance are not available. Certain important changes have been introduced, the following being noticeable when comparing this engine with the standard Dagger III.

Provision is made for a D.H. constant-speed airscrew; finning on cylinders and cylinder heads has been improved, and the rear end of the engine, which has been entirely redesigned, incorporates a new supercharger and a re-arrangement of accessories. Like the standard Dagger, the E.108 is of 16.8-litres capacity. The airscrew shaft has been geared up above the centre line of the engine.

A case displaying a representative selection of Rapier engine parts of standard workmanship and finish will also be shown.

Makers: D. Napier and Son, Ltd., 211, Acton Vale, London.



The Cirrus Major 150, shown above, is fitted with a flame trap—but one of many accessories which are available.

POBJOY.—A completely cowled Niagara V engine, a partly erected crankcase, a crankshaft and connecting rod assembly will be on view on Stand N, reserved by Pobjoy Airmotors.

A description of the new Niagara V, together with a power curve was published in *Flight* of June 17. This unit is particularly remarkable for the increased output as compared with its immediate predecessor, the Niagara III. Although substantially of the same size and weight the continuous cruising power of the Niagara V is rather better than the maximum output of the earlier engine. The bore is now 81 mm., the cruising r.p.m. 3,700, and the compression ratio 8:1. One hundred horse power is available for continuous cruising and the maximum power and speed are 130 h.p. at 4,400 r.p.m.

Makers: Pobjoy Airmotors and Aircraft, Ltd., Rochester Aerodrome, Kent.

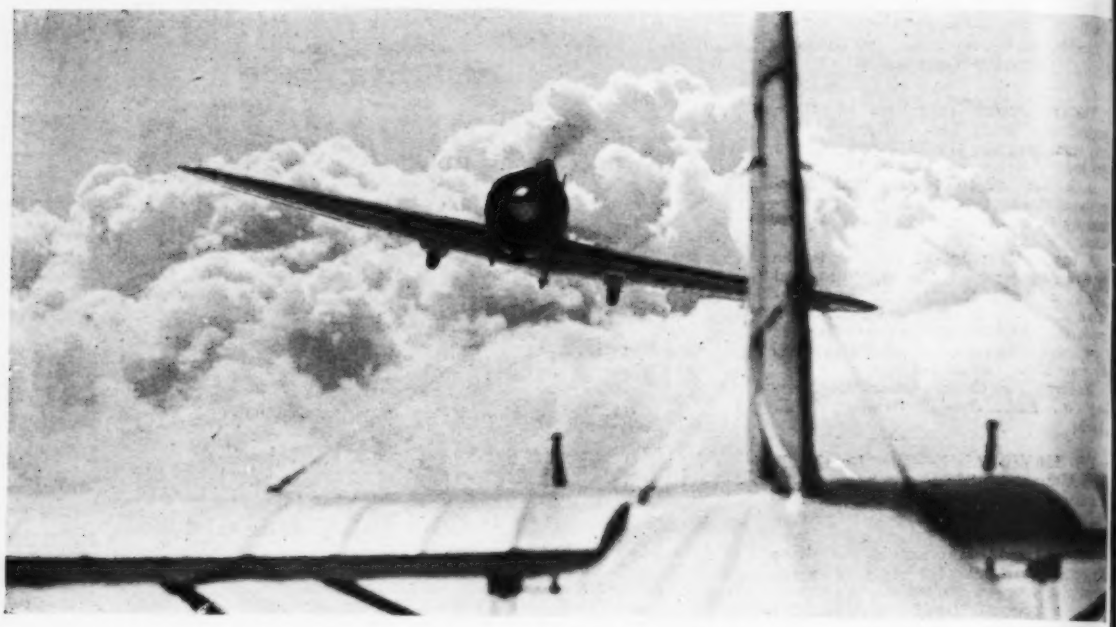
ROLLS-ROYCE.—The high-light of the Rolls-Royce stand (H) will, of course, be the vee-twelve glycol-cooled fully supercharged Merlin now in quantity production for the R.A.F. This engine gives 990 h.p. at 12,000 ft.: the maximum output is 1,050 h.p., and the weight 1,318.5 lb. The Merlin will be shown fitted with one of the Rotol airscrews which operates on a system whereby the blade pitch is controlled by the difference between two oil pressures operating on each side of a piston the movement being communicated to the blades through links. These pressures are provided, and their difference adjusted, by, an engine-driven pump and governor unit.

In addition to the Merlin, there will be the latest fully supercharged Kestrel XVI as lately supplied to Yugoslavia and South Africa. This is also the power plant of the Miles private venture advanced trainer to be seen in the flying display. The XVI is the latest of the Kestrel Series and with a fixed pitch airscrew is rated at 690 h.p. at 2,600 r.p.m. at 11,000 ft., the maximum power being 745 h.p. at 3,000 r.p.m. at 14,500 ft. This unit has been cleared by type test for operation with a two position variable pitch airscrew, the oil control valve for the actuation of this unit being easily fitted.

Makers: Rolls-Royce, Ltd., Derby.

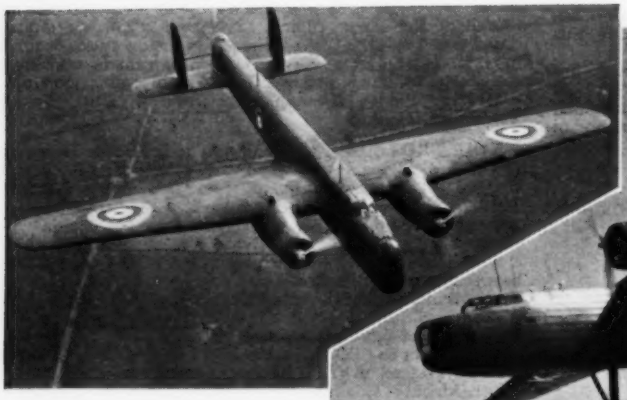
Supper Patrol

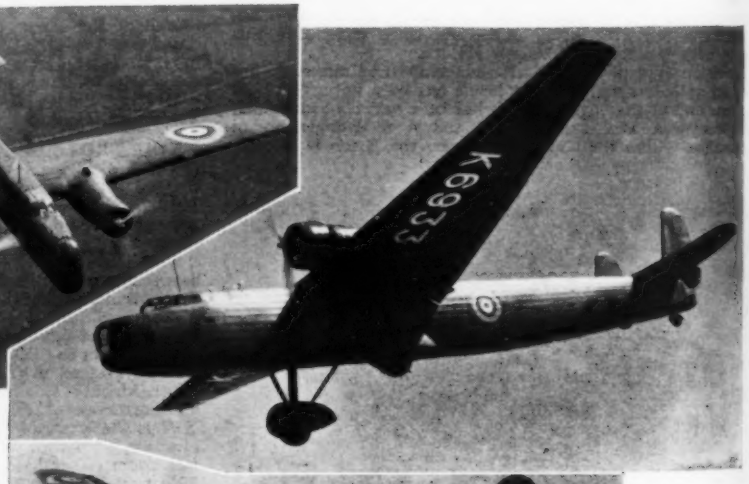
DAWN Patrols, which were, we believe, first organised and run by the Brooklands Club, become more and more popular, and it is natural, perhaps, that the originators should be the first to organise a variation in the same theme—to wit, a Supper Patrol. On Sunday, July 4, between 6 and 6.30 p.m., visitors are invited to make an attack on Brooklands, and, by way of a change from free breakfasts, a money voucher prize will be awarded to the pilots and passengers who are successful in eluding the defenders.

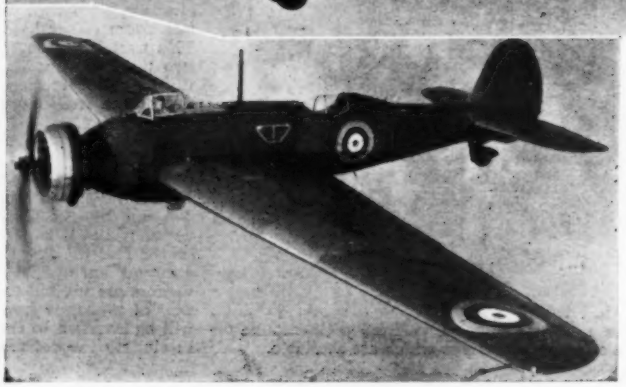


BACKGROUND : The latest of a long and brilliant line of Gloster fighters, the new multi-gun monoplane is designed to take a Bristol radial. A Mercury is installed in the prototype, seen here looking in on Hawker's "—MR," but a sleeve-valve Perseus may later be substituted. (*Flight* photograph)

AT HENDON NEXT SATURDAY



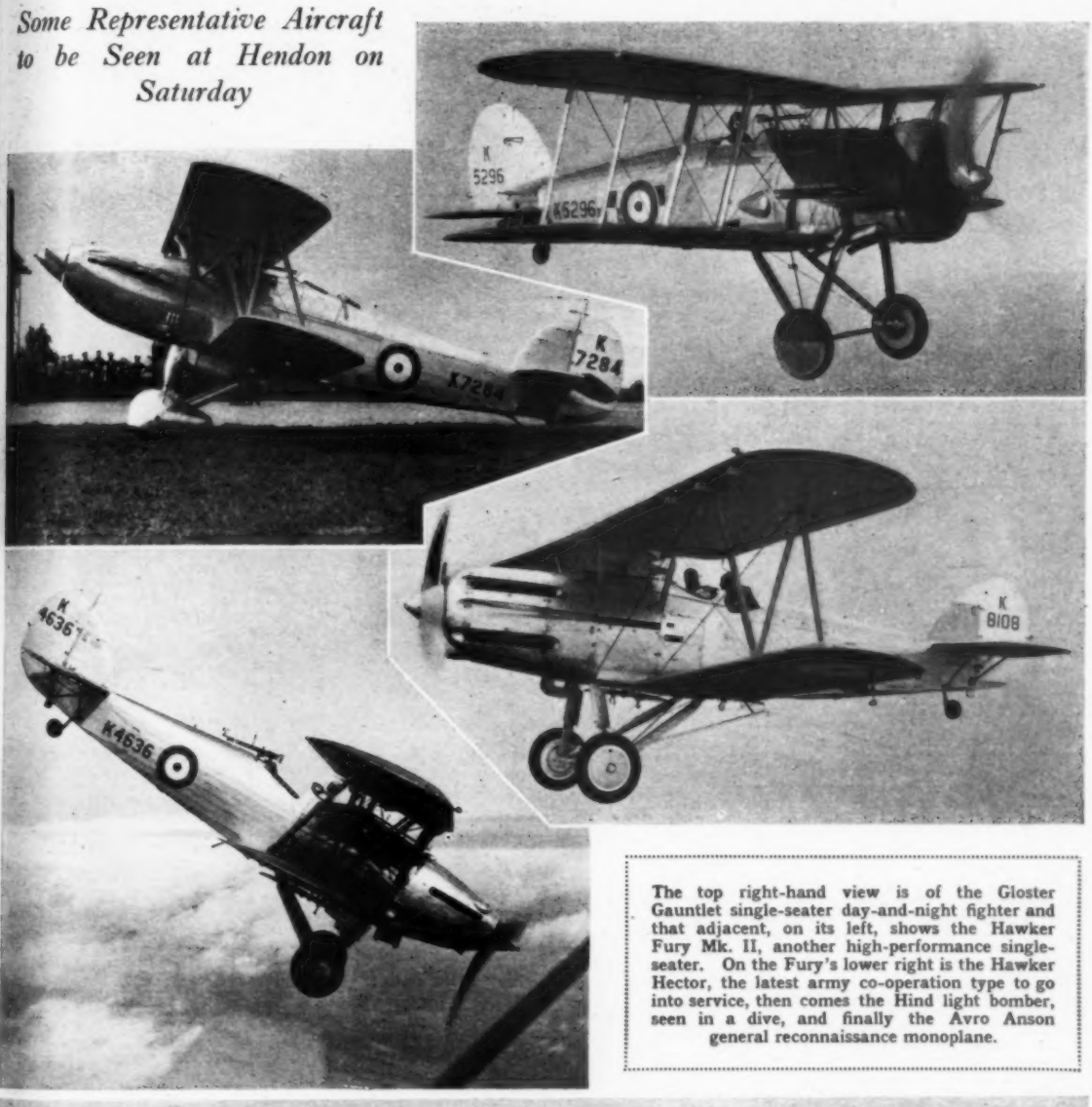




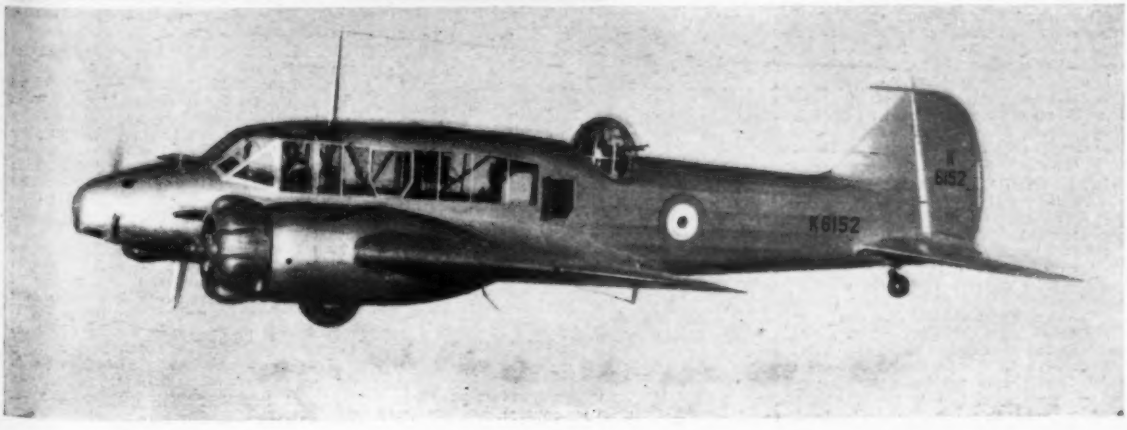
A selection of high-performance bombers which will be seen operating as standard equipment during the R.A.F. Display. The Armstrong Whitworth Whitley (top left) is a heavy bomber with two Siddeley Tiger engines, which, in later models, have two-speed superchargers The Handley Page Harrow (top right) is in the same category and mounts a pair of Bristol Pegasus engines. Below the Harrow is the Vickers Wellesley, intended for general purpose work and long-range bombing operations. The engine is a Pegasus.

MORE SERVICE TYPES in the DISPLAY

Some Representative Aircraft to be Seen at Hendon on Saturday



The top right-hand view is of the Gloster Gauntlet single-seater day-and-night fighter and that adjacent, on its left, shows the Hawker Fury Mk. II, another high-performance single-seater. On the Fury's lower right is the Hawker Hector, the latest army co-operation type to go into service, then comes the Hind light bomber, seen in a dive, and finally the Avro Anson general reconnaissance monoplane.



AT the "STATIC" SHOW

Components, Accessories and Materials to be Exhibited by Nearly a Hundred Firms : A Useful Guide.

IN the pages that follow, the productions of the hundred-odd firms exhibiting in the "static" section of the S.B.A.C. Display at Hatfield on Monday and Tuesday have been grouped in appropriate sections for easy reference. It will be found that firms are alphabetically arranged within each section, and that where one concern's products fall within two or more sections to any notable degree, a cross-reference to the principal section is given.

Engines are reviewed separately, on pages 642-645.

Aircraft Constructors' "Indoor" Exhibits

AIRSPEED (Stand C).—Detailed models of the Envoy will be shown, one with cut-away fuselage side, another of a special machine recently delivered, and a third of the convertible-Envoy, with its equipment removable to show how the aircraft can be rapidly converted from its civil to its military form. In addition there will be a working model of the Airspeed retractable undercarriage and suitable literature.

Makers: Airspeed, Ltd., The Airport, Portsmouth.

ARMSTRONG WHITWORTH (Stand F).—This exhibit will consist of parts of the A.W.27 or Ensign class heavy transport landplane, a quantity of which are now in production for Imperial Airways. The parts include a main plane rib with a section of the box spar. Owing to limited space the rib shown will be one positioned on the aircraft midway between the fuselage and the wing tip. There will also be a tail plane rib with a section of the box spar. This is of similar construction to the other rib. Models and photographs will complete the exhibit.

Makers: Sir W. G. Armstrong Whitworth Aircraft, Ltd., Whitley, Coventry.

BLACKBURN (Stand M).—Both Blackburn and Cirrus exhibits will be shown on one stand. The aircraft exhibit will consist of the front portion of a Shark seaplane float, showing the frames, stringers and plating, all of which are of Alclad material, riveted with Duralumin rivets. This exhibit will be only partly plated, and will be mounted on a turntable stand, so that inspection of the interior is facilitated. The Shark floats are specifically designed for rough-water conditions and have gained an excellent reputation for sturdiness and good performance. Shark seaplanes have been supplied not only to the R.A.F., but also to the Portuguese and Canadian Governments. The Cirrus exhibits will consist of one Cirrus Major of 138-150 h.p., and one Cirrus Minor of 75-85 h.p. Both engines of the air-cooled four-in-line type, and lightness and simplicity are outstanding. In addition to these exhibits there will be small miscellaneous exhibits consisting of a model of the new dive bomber and a model of the Shark together with miscellaneous photographs of Blackburn aircraft, and of aeroplanes fitted with Cirrus engines.

Makers: Blackburn Aircraft, Ltd., Brough, E. Yorks.

HANDLEY PAGE (Stand A).—The five exhibits here will be as follows: (1) Model of the H.P.52 ("Hampden") twin-engined long-range medium bomber. (2) Demonstration model of the Handley Page slot, showing the automatic action of the slot at various angles of incidence of the wing. (3) Demonstration model of the latest Handley Page patented rear slotted flap mechanism. This mechanism is entirely contained within the wing and thus causes no drag-producing excrescences. In this particular instance the model flap is operated by a hydraulically worked system designed by Lockheeds, which system is in every way similar to that used on the Handley Page Harrow heavy bombers. (4) Handley Page patented electrical bomb release gear demonstration set showing model of selection firing and fusing the bombs. (5) An Alclad tank constructed by the De Bergue riveting system, for which Handley Page are the inventor's sole foreign agents.

Makers: Handley Page, Ltd., Cricklewood, London, N.W.2.

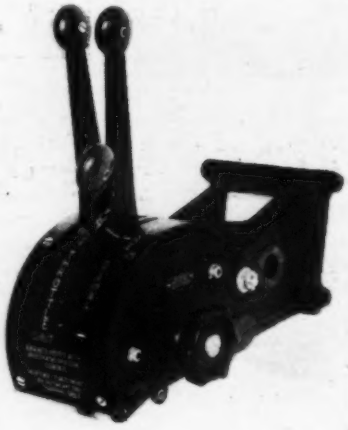
Engine Components

AMAL (Stand 65).—Flame traps and fuel pumps are two interesting exhibits to be shown by this firm. The flame trap, of course, is a safety device for fitting into the main air intakes of carburettors or in a tank filler neck. Fuel pumps, mechanically driven from the engine, will be shown in single and duplex models. Other items of interest on this stand will be the flush-fitting, self-fixing cowl fasteners and fuel pressure regulators designed to regulate the fuel supply to the carburettor at a predetermined figure irrespective of the delivery pressure from the feed pump or tank, where such pressure is within the range of 4-10 lb. per sq. in. Finally, there will be control rods with ball and roller joints, flowmeters, jet calibrating machines, oil thermometer pockets, petrol filters and Bunsen burners.

Makers: Amal, Ltd., Holford Works, Perry Barr, Birmingham, 20.

BRICO (Stand 4).—The exhibits on this stand will comprise a full range of Brico piston rings and scraper rings for aircraft purposes. Besides rings manufactured from 4K6 material there will also be those made from Brilybdenum, which is a special high-duty piston ring material designed to stand up to excessive heat. Brilybdenum has a high elasticity value and tensile strength. It also resists the scoring tendency which is frequently experienced in high temperature engines with steel cylinders. Other exhibits will include sodium-filled valves, special alloy pistons and samples of high duty alloys for special purposes.

Makers: The British Piston Ring Co., Ltd., Holbrook Lane, Coventry, England.



Hobson master throttle control for twin engines, with single two-position mixture control.

B.T.H. (Stand 44).—The magneto exhibits will comprise a selection from the full range, including examples of the rotating armature, polar inductor and rotating magnet types. There will also be exhibited engine starters, hand starter magnetos, lightweight air compressors and electric tachometer equipment. A display of Mazda lamps will occupy a position of prominence on the stand. This display will include 12-volt lamps in sizes ranging from 12 to 26 watts for the lighting of cabins, instrument boards, and for other interior uses in aeroplanes. Low voltage, high wattage lamps, developed for use as landing lights, will also be shown, with projector lamps. The line filament lamps are particularly suitable for certain types of equipment. There also will be seen Mercra (electric discharge) lamps which are particularly suitable for the economical lighting of large interiors.

Makers: The British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C.2.

BURGESS.—*See "Miscellaneous."*

CALLENDER'S CABLE (Stand 33).—This company will exhibit a special arrangement of samples of all types of electric cables and flexibles for aircraft installation and for use on aero engines. The cable finishes shown will include armouring, moisture-resisting and all other types manufactured. Aircraft photographs of all modern types wired with cables of the firm's manufacture will be shown, together with a model of an Imperial Airways' machine, in the original of which these cables have been installed.

Makers: Callender's Cable and Construction Co., Ltd., Hamilton House, Victoria Embankment, London, E.C.4.

ENGLISH STEEL CORPORATION.—*See under Metals.*

HOBSON (Stand 2).—A range of aircraft carburettors of various types and sizes will be exhibited by this firm, with automatic mixture, boost and cockpit controls, electrical ice-warning and alcohol de-icing units, a compressed-air operated fuel pump and depression gauge. The principal exhibit will be a working model of the Hobson master control scheme. This consists of a Claudel-Hobson carburettor in which is incorporated a three-stage boost control, automatic mixture control and the necessary linkage, the whole being coupled up to a cockpit control. This arrangement is such that, due partly to the construction of the carburettor and also to the interlocking of the levers, it is impossible for the pilot to give an incorrect mixture strength under any conditions. It is also impossible for him to stall his engine by using a weak mixture when landing. An entirely new exhibit will be an engine-driven hydraulic pump for undercarriage operation, etc.

Makers: H. M. Hobson (Aircraft and Motor) Components, Ltd., 47-55, The Vale, Acton, London, W.3.

K.L.G. (Stand 87).—The centre piece of the K.L.G. display will consist of a greatly enlarged model of the mouth of one of the platinum-pointed types which are now in full production, while various examples of chromium-plated and sectioned plugs of the normal type will flank this model. Another development which is being publicly shown for the first time is the integrally screened plug (to prevent radio interference) for use with an ignition harness. Detachable screens will also be shown, together with a representative range of plugs, including the K.L.G. Wizard, which are available with the standard screw-ended thread, ball-ended terminals and other fittings designed to meet particular requirements. It will be possible to examine all the exhibits very closely as the mounting rails are rotated.

Makers: K.L.G. Sparking Plugs, Ltd., Putney Vale, London, S.W.15.

LIGHT PRODUCTION CO. (Stand 16).—The exhibits on this stand will consist of

compression and oil control rings, gudgeon pins and Aerolite pistons. The rings are manufactured from centrifugally cast iron to Air Ministry specification 4Kb. Rings in other irons will also be shown, particularly alloy irons of nickel-chromium and chromium-molybdenum—to which the name Thermocrom has been given—the chief characteristics of which are high physical strength and ability to retain radial pressure at elevated temperatures with a good recovery value. Special types of oil control ring will be seen, these having varying unit cylinder wall pressures depending upon the degree of control to be exercised. Gudgeon pins of all types are manufactured, a particular feature being the attention given to heat treatment. Aerolite pistons will, of course, be shown, and an interesting feature in the form of an elliptical piston skirt is introduced. This is designed to give continual parallel action of piston rings, irrespective of engine temperatures or loads, thereby assisting the retention of maximum compression and predetermined oil control.

Makers: The Light Production Co., Ltd., 60-66, Rochester Row, Westminster, S.W.1.

LODGE (Stand 41).—Probably the most interesting exhibit on this stand will be the radio-screened plug which is supplied with 12 mm., 14 mm. and 18 mm. threads, varying in lengths of reach. This screened plug is completely opaque to electrical radiation and the screen forms an integral part of the plug. Two types of terminal assembly can be supplied, one for coupling to screened harness, conduit type, using ordinary insulated cable, and the other with a coupling to take metal-braided cable. The connection to the high tension cable is easy to make and renew. In addition to screened plugs there will be a complete range of unscreened Lodge aviation plugs in the three standard thread sizes. The plugs shown will be those approved for all British aviation engines and most Continental and American engines.

Makers: Lodge Plugs, Ltd., Rugby.

JOHN MARSTON (Stand 59).—Radiators and radiator parts will be shown by this firm, whose exhibit will also include oil coolers of the type recently evolved in conjunction with the R.A.E. at Farnborough. Also to be seen on this stand will be all kinds of sheet metal work in aluminium alloys and brass for use in cowlings and fairings, as well as machined parts, welded fittings and pressings.

A varied quartette of Wellworthy piston rings

ROTAX (Stand 35).—In addition to the new S.P.9/6 magneto fitted with double contact breaker and adaptor for screened harness, the S.P.8.8, the S.P.12/3, and a small single-cylinder rotating magnet magneto, Rotax, Ltd., will be exhibiting examples of the Rotax-Eclipse direct cranking electric starter. These include the E.160.C combined hand and electric type and the Y150B. direct cranking electric starter. The hand inertia starter will again be included, and it is probable that there will also be a new combined hand and electric starter. Three sizes of generator will be on view, two types of which are available—the shunt wound model, used in conjunction with an external Tirrill type of regulator, and the Air Ministry pattern incorporating Sykes control field regulating system. Rotax and Rotax-Harley landing lights will also be exhibited, the latter for the first time since Rotax have taken over the manufacturing rights, as well as Rotax type "B" and Nife batteries and numerous electrical details, such as switch boxes and transformers.

Makers: Rotax, Ltd., Willesden Junction, London, N.W.10.

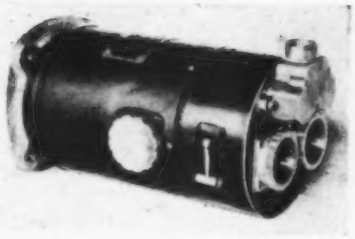
SIMMS (Stand 70).—The range of aircraft magnetos to be shown by this concern will include a series of induction types for 9-, 12-, 14- and 18-cylinder engines, manufactured under R.B. licence. These machines are designed with a compensated cam for radial engines. Their light weight is a particular feature, a 14-cylinder screened model scaling only 11½ lb. Automatic advance is incorporated within the magneto. The Aero 1 (with 6-cylinder distributor) and the Aero 4 are of the rotating-magnet, fixed-winding type. Either of these machines can be supplied with or without impulse starter. The Simms SRM/6 magneto and the C.S.6 type battery ignition and coils will also be shown. In the range of diesel equipment will be a Simms Uniflow 6-cylinder fuel pump and also a single-cylinder type, in section. Vernier couplings will be seen, as well as magnetic-type petrol gauges.

Makers: Simms Motor Units, Ltd., Oak Lane, East Finchley, London, N.2.

TECALEMIT (Stand 29) will exhibit a new system of hydraulic power transmission by high-pressure rotary pumps and motors; oil filters (full flow) as standardised on Bristol and other makes of aero engine; diaphragm fuel pumps for lightweight aero engines; specialised lubricating systems for engines, controls, etc.; stabilisers for flying controls; automatic shut-off nozzles for safe, rapid refuelling of aircraft; and quick-fix cap and seating for aircraft tanks. Other appropriate products of the Company, not on show, include bulk oil filters for engine test beds; bulk petrol filters with de-aeration device; water filters; bulk oil and water heaters; portable manual and power refuelling pumps; air compressors; grease compressors and portable oil-draining apparatus.

Makers: Tecalemit, Ltd., Great West Road, Brentford, Middlesex.

VOKES (Stand 26).—This firm will display a selection of aircraft exhaust silencers operating on the venturi principle, for which they are well known. These will include the first silencer ever approved by the Air Ministry. This has an historical interest inasmuch as it passed all tests at Farnborough, giving a reduction of 26 decibels with extremely low back pressure of 6.5in. of mercury. Since 1934 the silencer has been considerably improved, and it is now possible to obtain a sound reduction of from 22-23 decibels with a back pressure of only 0.5in. of mercury. At the same time the weight has been reduced from 30 to 22 lb. Air filters will also be exhibited with photographs showing the fitting arrangements. Latest developments will be illustrated by the panel-type design in which the filter is built into the engine cowling. Various oil filters of the detachable head type will be exhibited, as well as the Protectomotor air filter for ground equipment and panel air filters for cabin and building ventilation. By means of a working model the high dust separation obtained by these air filters will be demonstrated.



Rotax 1,000-watt generator, as used on the Empire flying boats.

Makers: Vokes, Ltd., 95-103, Lower Richmond Road, Putney, London, S.W.15.

WELLWORTHY (Stand 36).—With the considerable increase in piston speeds and the raising of pressures and temperatures, special material is becoming necessary for the manufacture of piston rings. After research in association with aero engine manufacturers this company produced a cast-iron alloy which seemed to meet all the requirements. This was designated Thermocrom and was duly patented and approved by the Air Ministry. The principal claims for this material are that it possesses the greatest strength and elasticity of any cast iron from which piston rings are made, and exceeds by at least 25 per cent. in tensile strength the normal piston ring material and gives a much slower rate of wear both on rings and wall. Within the limits of the Thermocrom specification it is possible to produce cast iron having tensile strength of 20 tons/sq. in. and upwards and a Brinell hardness figure of from 200 to 500. The Wellworthy exhibit will consist of a complete range of gas and scraper rings manufactured by their patent process and supplied to the principal firms in the aircraft industry, including special type rings in stainless steel as well as those manufactured from the normal piston ring material and Thermocrom.

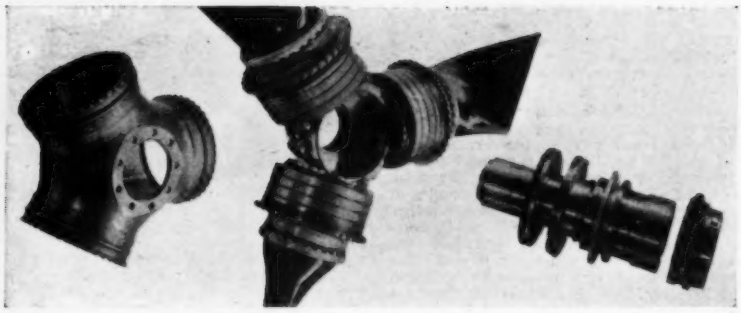
Makers: Wellworthy Piston Rings, Ltd., Stamford Road, Lymington, Hants.

Airscrews

AIRSCREW CO. (Stand 82).—This company will exhibit its latest type of three-blade airscrew with Schwarz detachable blades. The example on view is that designed for the Perseus VIII-engined Vildebeest. The diameter of this airscrew is 12ft. yet the weight is only 184 lb. The steel hub is of unique design and weighs little more than the standard hub which it replaces. The studs which hold the blades against centrifugal loads and so forth are preloaded to a figure depending on the condition of maximum stress, and a special spanner is supplied to ensure that each stud is preloaded as near as possible to the same degree. A chart gives some idea of the weight which can be saved by using wooden blades in association with variable-pitch hubs. As the main part of the blade is composed of softwood having a specific gravity of 0.5, and as the amount of compressed wood remains constant for a given root size, the reduction of blade weight compared with other materials becomes greater as airscrew diameter increases. For a tip speed of 850ft. per second three-bladed airscrew root sizes are calculated as follows: 100 m.m. for 270-530 h.p.; 120 m.m. for 530-750 h.p.; 150 m.m. for 750-1,150 h.p.; 170 m.m. for 1,150-1,500 h.p.; and 190 m.m. for 1,500-1,800 h.p.

Makers: The Airscrew Co., Ltd., Weybridge, Surrey.

DE HAVILLAND (Stand K).—The D.H c.p. airscrew exhibit will consist of seven



Hub of the hydraulically operated Rotol constant-speed airscrew.

items, as follows:—(1) A 5,000-size airscrew complete. This three-bladed type is suitable for engines up to 1,000 h.p., has a maximum diameter of 13ft. (3.96 m.), and a maximum weight of 300 lb. (163 kg.), and the pitch range may be either 10° or 20°. (2) A 1,000-size two-blade airscrew, of which the pitch changing is worked by mechanical means and can be observed by visitors. (3) A sectioned controllable-pitch mechanism. (4) A sectioned constant-speed unit. Weighing up to 4 lb., it is suitable for all the different sizes of D.H. airscrew. (5) A dismantled two-blade airscrew to illustrate the standard of finish and inter-relationship of the component parts. (6) Finished components, such as the spider, barrel and blade placed adjacent to the forgings from which they are made. (7) A damaged blade placed beside a blade in perfect condition to demonstrate the capabilities of the Servicing Department.

Makers: De Havilland Aircraft Co., Ltd., Hatfield.

FAIREY (Stand I).—Here there will be examples of a new type of controllable-pitch airscrew. This is infinitely variable, being hydraulically operated by engine oil pressure. The blades can be locked in any position and the type can be fitted to any engine without modification. Both two- and three-blade versions will be shown, the former, designed for a Genet Major, weighing 60 lb. with controls, and the latter for a Cheetah XI engine, weighing 110 lb. A fixed-pitch three-bladed airscrew will also be shown with a "D"-type one-piece two-bladed airscrew made from a single flat forged blank of duralumin or other light alloy, which is twisted in the centre by means of a hydraulic press.

Makers: The Fairey Aviation Co., Ltd., Hayes, Mddx.

JABLO (Stand 17).—The airscrew covering developed by this concern consists of a coating over the whole airscrew of a patented cold-treated synthetic resin, which gives a natural glazed surface, with a sleeve of metallic gauze surrounding the blade embedded in the resin from a distance of two-thirds or more from the tip inwards. The resilient edging is of moulded rubber, the leading edge of the metal gauze being embedded therein. This covering stiffens up the blade and is transparent, while the rubber edging forms a shock-absorbing protection. The exhibits will include fixed-pitch wooden airscrews in two sizes; a fixed-pitch airscrew of reinforced wood; an adjustable pitch hub with reinforced wood blades; and detachable blades of reinforced wood for adjustable or variable pitch airscrews. All these airscrews are, of course, Jablo covered.

Makers: Jablo Propellers, Ltd., Brettenham House, Lancaster Place, London, W.C.2.

LANG (Stand B).—The most interesting part of this exhibit will consist of airscrews with the new B.T.H. reinforced protective covering. The leading edges of the blades are reinforced with additionally treated fabric, which enables metal sheaths to be entirely dispensed with. The covering, it is claimed, has no tendency to crack due to the blade flexing and does not harden with age or deteriorate. Owing to the high energy-absorption of the covering, chance vibrations of the blade and resonance to engine vibrations are damped out. The process has received the full approval of the Air Ministry.

Makers: Long Propellers, Ltd., Walton Works, Peterborough.

ROTOL (Stand 34).—As recently related in *Flight*, Rotol Accessories, Ltd., is the outcome of co-operation between the Rolls-Royce and Bristol concerns in marketing constant-speed airscrews. The company will display a 12ft. 9in. hydraulically operated constant-speed airscrew with magnesium blades operating on the Hele-Shaw principle. This type is the first constant-speed airscrew to pass a British Air Ministry type test, having successfully completed approval and flight test on a Bristol Pegasus X engine. Another Rotol hydraulically operated type has completed approval tests and flight tests on Bristol Mercury VIII and XI engines, whilst a third has completed tests on a Rolls-Royce Kestrel. A Rotol airscrew will be fitted to a Merlin engine on the Rolls-Royce stand, whilst there will be a similarly equipped Mercury engine in the Bristol Company's flying demonstration.

Makers. Rotol Airscrews, Ltd., Llanthony Road, Gloucester.

Undercarriages, Hydraulic Equipment, Wheels, Brakes and Tyres

AIRCRAFT COMPONENTS, LTD. (Stand 75).—Here will be found a complete working installation of hydraulic equipment, consisting of a cockpit with controls for operating undercarriage, flaps, wheel brakes and guns. Power is supplied by an engine-driven pump (by-passing at no pressure until required) which delivers 10 gallons of oil per minute at a pressure of 500 lb. This power is distributed by a single-lever control unit. A retracting undercarriage will be exhibited embodying an improved version of "nutcracker" retracting radius rod and the latest type of mechanical lock. This is operated by the first motion of the main jack, instead of by an auxiliary jack as in the past. The Dowty undercarriage indicator will be shown, incorporating not only red and green lights, but also mechanical models of the undercarriage retracting tail wheel and flaps as well as a warning Klaxon. The wheel brake and gun-firing mechanisms are designed and supplied by Dunlops, with a view to their being operated by the Dowty hydraulic system.

Makers: Aircraft Components, Ltd., Cheltenham.

AVERY (Stand 25).—The Avery brake is entirely enclosed, so that it is unaffected by water or grit and it is impossible for the brake to "seize on." The wheel rim is supported at its extreme edge by the brake casing, thus allowing of much lighter construction and great saving in weight. The brake consists of an anular capsule enclosed between two friction-lined flexible discs. Fluid pressure (air or oil), applied to the capsule, forces the discs apart and into frictional engagement with the steel-lined enclosing case, which latter dissipates the heat well away from the tyre tube. The "unit" type of Avery wheel and brake can be removed in one piece by detaching the axle nut. A detachable type is also available, in which case the wheel only is removed by detaching three studs as in motor car practice.

Makers: Avery Equipment, Limited, The Green, Twickenham.

BENDIX, on Stand 30, will be showing fluid and mechanically operated brakes of their already well-known servo type, but now designed to give equal braking in the reverse direction. In the fluid-operated brakes the operating cylinder is isolated from heat effects and easily accessible without disturbing brake parts. Conversely, the shoes may be removed without dismantling the cylinder.

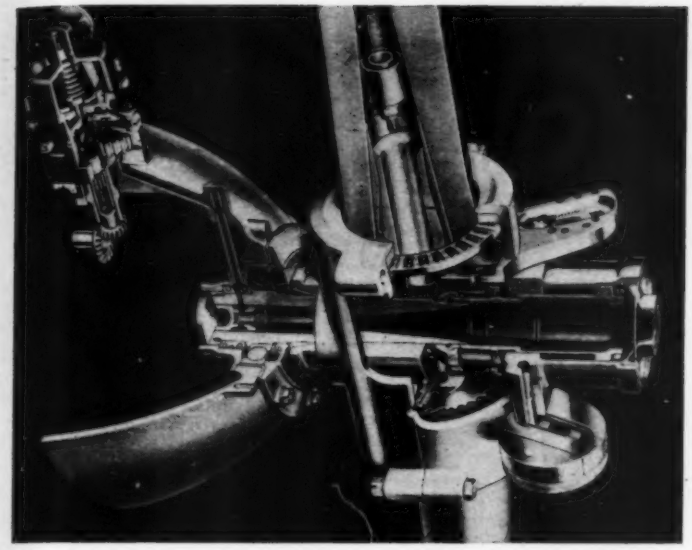
A particularly interesting differential control unit for the air-operated brakes will be shown. It is coupled to the rudder bar, is trigger controlled and is so designed that ground steering is performed by light applications of one brake at a time to correspond with rudder bar movements. No preliminary application of both brakes is required, thus permitting control during take-off without checking speed and conserving the compressed air supply. The control trigger in its first or flight position renders the brakes inoperative. Movement to second position brings the differential braking into phase with the rudder bar, and further pressure applies both brakes up to full power for stopping or parking, but still permits differential braking.

Makers: Bendix, Ltd., Tyseley, Birmingham.

DUNLOP (Stand 1).—In the Dunlop pneumatic aircraft brake system and machine-gun operating gear air is stored in a suitable container at a pressure of 200 lb./sq. in. A lever on the control column operates the dual relay control unit, which admits air to the brakes. The control unit is also connected to the rudder bar and thereby differential braking is obtained. A separate pipe branches from the supply line and is led to the gun button installed in the spade grip, and from there direct to the operating units of the machine gun, camera gun, etc. The Dunlop (power) hydraulic brake system depends for its power supply on a pump operated by the engine, which delivers oil at a pressure of 500 lb./sq. in. This power is used to operate the brakes in a manner identical with that of the Dunlop pneumatic operation. This hydraulic system can also be used for subsidiary services. An ingenious demonstration model will show how a tail tyre with tread made from "Ecta" electrically conducting rubber enables any static charge of electricity acquired by the aircraft during flight to be discharged instantaneously on landing. Lastly, there will be seen the Dunlop hand-operated hydraulic gear, an essentially simple system, light and foolproof.

Makers: Dunlop Rubber Co., Ltd., Fort Dunlop, Birmingham.

LOCKHEED (Stand 81).—One interesting feature of this exhibit will be an undercarriage jack having a maximum thrust of six tons and an extended length of 84 in. It has been designed specially for the retractable undercarriage of the A.W. Ensign class. The exhibit will include three typical Lockheed actuating jacks, one sectioned; a double actuating automatic hydraulic lock; a cockpit hydraulic hand pump; engine pump, as used in a variety of forms in a number of Service aircraft; hydraulic actuating equipment for wing-folding latches; undercarriage indicator and warning control—a complete electrical indicator system with both a visible and an audible warning device; selector valve—the standard control unit of all the latest Lockheed equipment; several examples of the "Airdraulic" strut; group remote control of jacks—a panel of



A sectional view of a De Havilland c.-s. airscrew hub, showing the central operating cylinder, the control unit, and other details.

working parts will be shown, from which can be seen the principles of operation of this system, which is intended to provide an easily installed and compact layout; constant-speed airscrew control, developed in conjunction with the De Havilland Co.; and, lastly, a demonstration set of equipment mounted in a mock-up fuselage and centre section. Many of these Lockheed specialities will be sectioned.

Makers: Automotive Products Co., Ltd., Leamington Spa.

PALMER (Stand 43).—At the time of going to press no details of this exhibit are available. It can be assumed, however, that these pioneer tyre manufacturers will display examples of their wide range of aero tyres, electrically conductive tail wheels, and aircraft wheel brakes.

Makers: The Palmer Tyre, Ltd., Thames House, Millbank, London, S.W.1.

TURNER'S (Stand 28).—Five principal items will be: (1) Pneumatic landing legs, working solely on compressed air with only a small amount of oil for lubrication purposes. The design permits of very lightweight structures. (2) Oleo-pneumatic landing legs, designed for heavier aircraft where the variation in weight between the light and laden condition is considerable. The design allows for taxying on air, landing energy being taken on oil. (3) A hand-operated air pump for filling pneumatic devices with air up to 1,200 lb. pressure. (4) Oil injectors for injecting oil against any air pressure. (5) Turner-Romec pumps, manufactured in this country on an American licence. A very wide range of pumps is available not only for fuel supply but also of the vacuum type for operating instruments, de-icing, undercarriage retraction, gun synchronising, etc.

Makers: Turner's Motor Mfg. Co., Ltd., Moorfield Road, Wolverhampton.

VICKERS (AVIATION), LTD.—*See under Components.*

Instruments and Controls

EXACTOR (Stand 11).—This firm will be exhibiting their hydraulic control in its standard form, arranged with interconnection between throttle and mixture controls in order to comply with modern engine requirements. This has been done under licence from, and in conjunction with, H. M. Hobson. The exhibit will also demonstrate alternative positions for the first and second pilots' control, and includes in the first pilot's battery a hydraulic control for the operation of a retractable landing lamp. The company will be introducing at this exhibition for the first time its mechanical control. This has been designed to meet the requirements of light duty operation over short distances in small- and medium-sized aircraft. It incorporates the Exactor spring mechanism, which is contained in two units mounted at either end of the system and is used to maintain a constant tension on the single wire which is the only connecting medium. The company's remote priming equipment will also be shown, this consisting of a priming unit situated on the engine and hydraulically operated from the cockpit.

Makers: Exactor Control Co., Ltd., Exactor Works, Mount Pleasant, Alperton, Middlesex.

FERRANTI (Stand 60).—Examples of aircraft instruments of designs recently approved by the Air Ministry will be shown by this firm, including engine speed and air speed indicators, fuel pressure gauges, fore and aft levels, compasses and engine cylinder thermometers. In addition, there will be various small instruments of the types used on radio transmitters and receivers, as well as various high-grade electrical testing instruments. There will also be a selection of valves, condensers and small castings representative of the company's general work.

Makers: Ferranti, Ltd., Hollinwood, Lancs.

HUGHES (Stand 94).—The most important exhibit on this stand will be the Smith automatic pilot. The use of such equipment is extending very rapidly and it is already being manufactured under licence in France. In addition to the automatic pilot, there will be the new Holmes teiecompass with repeater dials on show, as well as a comprehensive range of navigation instruments, including sextants, slide-rules, bombsights, course and wind calculators, and a full range of Husun compasses.

Agents: Smiths Aircraft Instruments, Cricklewood Works, London, N.W.2.

KELVIN (Stand 52).—A number of new instruments will be shown by Kelvin, Bottomley & Baird. The first of these is the K.B.B.-Martin colour vision lantern for testing the colour vision of pilots and others. Then there will be a boost gauge employing an indirect system of transmission, whereby any possibility of oil and petrol vapour reaching the operating mechanism is eliminated. More important still, an electrically heated pitot head which embodies an electric heater thermally integral with the outer casing of the nozzle will also be seen. The heater is thermostatically self-regulated. Finally, there will be aircraft compasses, petrol gauges, electrical r.p.m. indicators (employing a three-phase synchronous transmission system), and the recently introduced K.B.B.-Kollsman sensitive altimeter.

Makers: Kelvin, Bottomley and Baird, Ltd., 303, Shell-Mex House, Strand, London, W.C.2.

P.B. (Stand 31).—Apart from a sectioned model of the Deviator, a simple blind-flying instrument of the stabilised gyroscope type which has been in action for a number of years, this company will be exhibiting a sectioned model of an automatic directional control as well as the actual apparatus used for rudder and elevator operation. The latter will be a working model so that its response to movement may be properly demonstrated. Installation drawings and survey photographs taken with the help of the automatic control will also be shown. Ease of maintenance and general simplicity are features of this equipment. On the aerodrome an Air Dispatch Dragon will be seen with the P.B. automatic control arranged for air survey work.

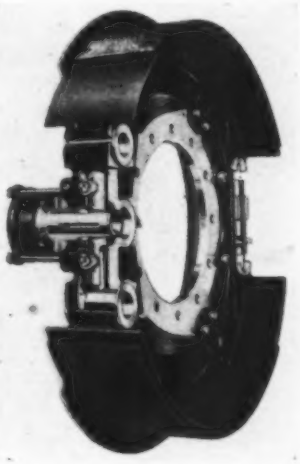
Makers: P.B. Deviator, Ltd., 42a, Sydenham Road, Croydon, Surrey.

SHORT AND MASON (Stand 6).—This well-known firm of instrument makers will be showing complete aircraft instrument panels, for military and civil types, with altimeters, air-speed indicators, revolution indicators, boost gauges, oil and fuel gauges, oil pressure gauges, radiator and oil temperature thermometers. In addition, there will be altigraphs, both of the service and portable types, air-speed recorders, air temperature strut thermometers, Brown turn indicators and Sestrel aero compasses of various types. Finally, there will be a selection of test apparatus consisting of substandard altimeters, portable mercurial test barometers, A.S.I. testing apparatus, a standard mercurial column, a standard boost gauge and an A.S.I. calibrator, with meteorological apparatus, including micro-barographs, thermographs, hygrographs, Stevenson's screen with meteorological thermometers, Robinson's and electric cup anemometers, Biram's anemometers, Dines meteorograph, and the like.

Makers: Short and Mason, Ltd., Aneroid Works, Macdonald Road, Walthamstow, London, E.17.

SIMMONDS AEROCESSORIES, LTD.—*See under Miscellaneous.*

SMITHS (Stand 94).—Here will be exhibited a twin-engine dashboard panel



In the Bendix fluid-operated brake, as fitted to the D.H. Albatross, the piston in the operating cylinder forces apart two tappets which bear on the shoes.

which, in addition to the usual complete range of Smith's instruments, includes also meters and switches for an electrical fuel gauge, a flap indicator and an undercarriage position indicator. The electrical fuel level indicator is well known and the two other instruments are operated on the same system and are already being standardised by a number of constructors. This dashboard also embodies the new blind flying panel in which are fitted air-speed, altitude, rate-of-climb and turn indicators, a sensitive altimeter, and a directional gyro. The Essex automatic anti-fire crash equipment will also be shown. This system can also be operated manually, and provides for fire extinction either in the carburettor and tank area or wherever the pipe line is directed. A Frazer-Nash safety enclosed wing-tip flare bracket will also be exhibited.

Makers: Smiths Aircraft Instruments, Cricklewood Works, London, N.W.2.

TELEFLEX (Stand 50).—The proprietors of the Teleflex remote control system will be exhibiting working models of control runs from 15 to 35 ft., operating four Vickers ¾-in. fuel cocks, Harley retractable landing light, two types of V.P. airscrew controls, and a carburettor cut-out for a Bristol engine. Also to be seen will be a working sectional model of a Bakelite operating box for 20 lb. push load, and samples of cables, conduits, control boxes, push-pull units and various sliding and swivelling ends for such things as V.P. airscrews, throttles, air intakes, landing lamps, ventilators, and indicator controls.

Makers: M.R.C., Ltd., 9, Cavendish Square, London, W.1.

Electrical Equipment

BONNELLA (Stand 83).—This exhibit will illustrate the firm's work as manufacturers of aero engine components and aircraft electrical equipment and accessories. Their works are equipped with the most modern plant and machinery for working to fine limits and their Bakelite moulding plant has been considerably extended to cope with the demand for this class of work, now so extensively used in the aircraft industry. They have been on the Air Ministry List of approved firms since 1926, and are thus authorised to release their products as to material, dimension and functional tests.

Makers: D. H. Bonnella and Son, Ltd., 46-48, Osnaburgh Street, London, N.W.1.

B.T.H. (Stand 44).—*See under Engine Components.*

DAGENITE (Stand 63).—Makers of Dagenite batteries, Peto and Radford manufacture a complete range of non-spillable types which are made up in one-piece moulded containers. Special construction of the plates allows heavy currents for electrical engine starting, and at the same time a steady output for supplying current to the navigation lights, radio transmission, landing lights, etc. The Davis non-spillable vent is used exclusively on all Service machines which are engaged in aerobatic flying. Battery capacities range from 15 ampere hours to 42.5 ampere hours. Peto and Radford also manufacture a special type of battery, made in 26 and 45 a.h. sizes, intended for use on non-aerobatic machines. They will also exhibit a high-capacity battery trolley for ground starting.

Makers: Peto and Radford, 50, Grosvenor Gardens, London, S.W.1.

GENERAL ELECTRIC CO., LTD.—*See under Aerodrome Lighting.*

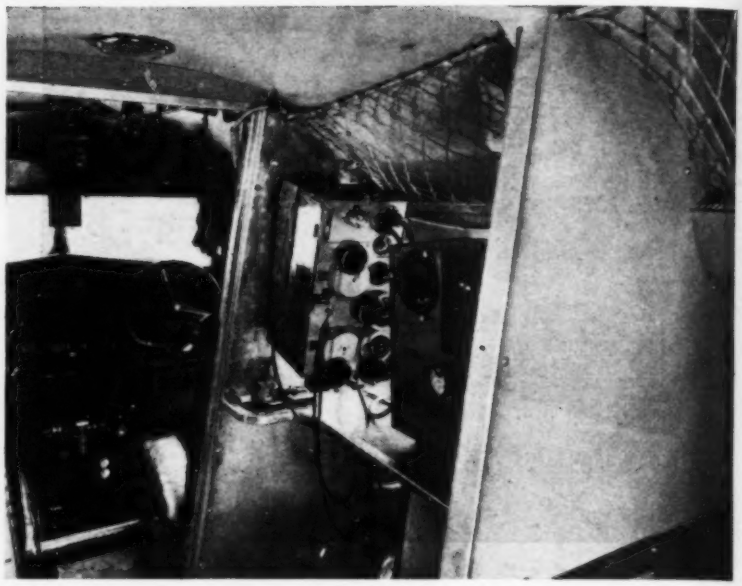
PLESSEY (Stand 68) exhibits will include the following items now being manufactured in this country for the Breeze Corporation of Great Britain: Complete ignition screening systems have been designed for practically all the modern aero engines, including the Merlin, Kestrel, Pegasus, Perseus, Mercury, Hercules, Tiger, Gipsy Twelve and Gipsy Six. The system uses a solid-wall tube as the main manifold with flexible leads to the distributor and plugs. A complete screening harness for the electrical system in aircraft is available. This takes the form of flexible screened tubes, with junction boxes and screened plugs and sockets for the cable terminations and joints. Ordinary electric cables are then fed through the screens. One advantage of this system is that it eliminates the necessity of large numbers of screened cables with different numbers of conductors and further that the addition of a wire or renewal of an existing conductor is an easy matter. By contrast, there will be fuel tanks of a novel design, with no riveting on the external surface; all joints are lapped and pressed. Other items include mechanical controls for trimming tabs, separable plugs, etc. The exhibits also include a homing receiver for aircraft, designed and manufactured by the Plessey Co. for sale by Radio Transmission Equipment, Ltd.

Makers: The Plessey Co., Ltd., Vicarage Lane, Ilford.

ROTAX (Stand 35).—*See under Engine Components.*

TECHNICAL IMPROVEMENTS (Stand 49).—Here will be displayed various types of the company's screening harness for both in-line and radial engines, together with accessories such as pipe couplings, clips and plug elbow fittings. The special features claimed for T.I. harness are minimum weight, obtained by the use of aluminium for the main ducts; maximum efficiency, obtained by the low electrical capacity of the system and the use of clamped sleeve joints throughout; and increased protection of the ignition cables from oil, petrol and water, obtained by the use of a varnished fabric covering over the braided metal of the flexible tubes connecting the main ducts to the plugs.

Makers: Technical Improvements, Ltd., 3, St. James's Square, London, S.W.1.



Marconi installation in a British Airways Lockheed Electra. On the forward bulkhead is the receiver-transmitter unit, and in the cockpit roof is the D/F loop indicator which has a repeater on the panel in the foreground.

Aerodrome, Route and Works Equipment

G.E.C. (Stand 54).—The General Electric Co. is arranging an interesting display of examples of electrical equipment. One of the chief features of the display will be a comprehensive range of lamps employed for the lighting of aircraft, aerodromes, hangars, and factories engaged in the production of aircraft and auxiliary products. Such lamps embrace both Osram lamps and Osira electric discharge lamps, with which many large installations at home and overseas have been carried out. There will also be shown examples of special apparatus designed by the Company for the flying industry, typical of the G.E.C. equipment, in the way of landing floodlights, boundary lights, obstruction lights and neon identification beacons specified for numerous Government and private aerodromes.

Makers: General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

Radio

MARCONI (Stand 69).—As might be expected, this firm, which has had a longer experience of aircraft radio development than any, will be showing a wide range of transmitting and receiving apparatus, including new designs for military transport machines; direction finding and homing devices; remote controls; constant speed generators; ignition screening harness; and wireless accessories. As more than ninety per cent. of British civil aerodromes on the Empire air routes, as well as many on the Continent and in other parts of the world, have Marconi installations the D/F receivers, with either Marconi-Adcock or loop aerials, are of particular interest. Lately the company has developed such a receiver, type D.F.G.12, for use on short waves, and both types will be shown. Other exhibits will be the type AD49/50 installation for smaller types; the AD55/56, with medium power and medium wave range, primarily for reconnaisance aircraft; the AD6072 medium-wave general-purpose direction-finding receiver with remote controls; the AD63/64 20-watt short-wave equipment with one remote tuning control, for fighter aircraft; the 6872 installation used on the Empire flying boats; the 75A/76A ultra-short wave (1.8-2 metres) R.T./W.T. transmitting and receiving equipment; the AD77A combined short- and medium-wave R.T./W.T. equipment for light bombers; remotely controlled loop aerials; and a number of other items of wireless equipment.

Makers: Marconi's Wireless Telegraph Co., Ltd., Electra House, Victoria Embankment, London, W.C.2.

R.T.E. (Stand 77).—Four separate radio installations will be exhibited by this firm. The first, known as the ARE.100, provides CW, ICW. and telephony long-range communication from 17-96, 17-190 and 500-1,000 metres, with homing reception and visual and aural D/F. Listening can be carried on through on all wavelengths and the use of homing and D/F is possible without the interruption of normal communications. The

ARE.101 is designed for smaller machines and caters for C.W., telegraphy and telephony communication, with a wave-range of 500 to 1,000 metres, and six preset wavelengths. It may be supplied with or without provision for homing and D/F. The ground station transmitter type, SWO. 2C.3F., allows C.W., telegraphy and telephony transmission, has a wave-range of 20 to 100 metres and has an output of 200 watts. Remote and local controls are provided. Finally, the approach beacon type SWB.O.075/B illustrates the R.T.E. system of blind approach.

Makers: Radio Transmission Equipment, Ltd., 225, Tottenham Court Road, London, W.1.

STANDARD (Stand 90).—This radio company will exhibit some very modern equipment. In particular an R.5 automatic radio compass, which indicates the bearing of any selected radio station just as the ordinary magnetic compass indicates the direction of magnetic North, will be shown. A compact combination of the R.10 S.W. transmitter and receiver provides immediate operation on any one of four predetermined frequencies. Provided with electric remote control, this equipment may be situated in any part of the machine. The simple but accurate R.9 "homing" direction finder, having facilities for both oral and visual indication, the particular feature of which is the extremely small loop aerial contained in a fixed streamlined casing, will also be shown. Other equipment includes a model of the Standard Adcock direction finder aerial system.

Makers: Standard Telephones & Cables, Ltd., Connaught House, Aldwych, London, W.C.2.

Dopes, Paints, Etc.

CELLON (Stand 85).—Here will be seen the well-known Cellon doping schemes "X," "X2," "Z" and "V"; matt cellulose finishes to DTD.314 and DTD.308; "Cerrex" anti-corrosive undercoats and temporary protectives, incorporating special chromates, covered by patents of H. Sutton and L. F. Le Brocq, for protection of all metal parts, particularly light alloys containing magnesium; "Cerric" and "Cerrux" finishes suitable for all internal structure; flockage process for the reduction of resonance and thermic insulation; jointing compositions; and a new rivet protection and covering process, which consists essentially of covering the heads and bases of rivets, overlapping joints, and any such surface irregularities in a simple and efficient manner to prevent corrosion, and at the same time produce a smooth surface.

Cellon, Ltd., Kingston-on-Thames, Surrey.

BERGER PAINTS (Stand 79).—On this stand will be found panels showing various types of aircraft dopes, together with panels showing cellulose spray enamels and lacquers, air-drying and stoving synthetic finishes, stoving enamels, and, in fact all types of aircraft finishes which Bergers produce to Air Ministry specifications.

Lewis Berger and Sons, Ltd., Homerton, London, E.9.

TITANINE (Stand 92).—Examples of Titanine doping and finishing schemes for service aircraft will consist of fabric and metal components lent by De Havilland and Handley Page, coated with dopes and cellulose and synthetic finishes, including the latest camouflage schemes. There will be examples of "Satin Finish" for the fabric and plywood surfaces of civil aircraft, applied on fabric panels and on a fabric-covered plywood wing section lent by Phillips and Powis. There will also be a set of sixteen photographs of aircraft of various types on which Titanine finishes are employed and a model of the D.H. Comet which won the England-Australia Race, showing the Titanine "Satin Finish" with which this machine was coated.

HALL (Stand 73).—This year John Hall and Sons have concentrated on two main items: (a) Finishing of civil aircraft in high-gloss finishes, giving very low skin friction, (b) protection of metal structures. These are illustrated by part of a Tipsy fuselage, with cowlings, etc., finished in cellulose enamel as standardised on production machines; by a Hendy Heck tailplane showing high-gloss finish on fabric and fabric-covered ply; and examples of protective covering for steel tubes, magnesium, Elektron, etc.

LLEWELLYN RYLAND (Stand 64).—Samples will illustrate the protective value of "Rylard" aircraft products. In keeping with the increased production of all-metal aircraft, Llewellyn Ryland, Ltd., have maintained their interest in protective coatings, as the continued success of their oil-bound undercoatings and aluminium pigmented cellulose finish for seaplane hulls and floats gives testimony. Recent developments in stressed-skin construction found this firm well to the fore with their matt pigmented oil varnish to specification D.T.D.314, and their filler for rivet heads. "Duralac" is the barium chromate filler referred to in A.D.M.323/324, Sect. (4), para (a), and deserves special mention as a filler for lapped seams in flying-boat hulls and other situations where dissimilar metals may be joined. Shown also will be examples of "Rylard" aircraft varnishes.

Makers: Llewellyn Ryland, Ltd., Balsall Heath Works, Birmingham, 12.

Window and Screen Materials, Plastics, Etc.

MOULDRITE, LTD. (I.C.I.) (Stand 56).—This exhibit will show some of the uses to which the transparent plastic "Perspex" has been put by aircraft manufacturers. Shaped windscreens, goggles, landing lights, etc., made from "Perspex" will be included and a special installation will demonstrate the material's almost total lack of light absorption. It is claimed that the consistent clarity of "Perspex" makes it invaluable for night flying, and that even after expesure to high ultra-violet conditions it does not become opaque or discoloured. It is further claimed to be free from warpage, shrinkage or brittleness occasioned by age or changes in humidity, while it retains its excellent mechanical properties at temperatures as low as −40 deg. C. It can be shaped, machined, drilled, turned, milled, tapped and cemented. These qualities have ensured its wide use in military aircraft. Phenol formaldehyde, urea formaldehyde, moulding powders and a number of mouldings demonstrating properties of resistance to shock, translucency, etc., will also be shown by Mouldrite, Ltd.

Makers: Mouldrite, Ltd. (Imperial Chemical Industries), Nobel House, Buckingham Gate, London, S.W.1.

MAY AND BAKER (Stand 74).—Samples of "Rhodoid" transparent acetate sheet, cut and drilled panels, moulded windows, fairings, etc., will be exhibited, together with moulded instrument covers and instruments fitted with such covers. Aircraft nameplates of "Rhodoid" will also be shown. An outstandingly interesting demonstration will show the use of special fluorescent sheet material enabling maps to be read in the dark by means of an invisible ultra-violet light. Another will show the merits of an anti-glare material from which roller blinds can be made for use in aircraft.

Makers: May and Baker, Ltd., 42-43, St. Paul's Churchyard, London, E.C.4.

TRIPLEX (Stand 72).—The centre of interest will be a complete turret, lent by A. V. Roe and Co., Ltd., as used in many of the types of Service aircraft at present under construction. All glazing for this turret has been carried out in "Perspex." In addition to this main exhibit there will be shown many examples of shaped and moulded "Perspex" which indicate the high degree of efficiency which has been attained by the Triplex Company in the manipulation of this material.

The Triplex Safety Glass Co., Ltd., 1, Albemarle Street, London, W.1.

Fuels, Oils, and Dispensing Equipment

ANGLO-AMERICAN (Stand 23).—Marketers of Stanavo fuels and oils, and also bulk storage installations and metering columns, this company will emphasise that at all recognised aerodromes and landing grounds throughout the world there is a Stanavo filling point with supplies of fuel and oil, uniform and reliable in quality. Pilots can take advantage of the Stanavo Carnet system, which relieves them of much of the troublesome detail usually met with when visiting foreign countries. This system allows supplies to be obtained at recognised Stanavo filling points on credit terms, the invoice being rendered on return to this country. The company's aviation department is also at the service of all concerned with aviation, including manufacturers, municipal authorities and the like.

Anglo-American Oil Co., Ltd., 36, Queen Anne's Gate, Westminster, London, S.W.1.

RAGOSINE (Stand 80).—The Ragosine Oil Co., Ltd., was established in 1878, and is one of the oldest mineral lubricating oil companies in the world. Of recent years the company has met with success in obtaining orders from foreign air ministries, and, it is stated, a great number of members of the aircraft industry in this country are users of the Ragosine products. The company's stand at the exhibition will have as background an enlarged facsimile of the "Minix" aero oils booklet. On a counter in the forefront of the stand a comprehensive range of the company's products will be displayed in show bottles, and glass tubes containing "Minix" aero oil will be displayed on a suitable disc, intermittently illuminated from behind.

The Ragosine Oil Co., Ltd., 161, Bow Road, London, E.3.

SHELL (Stand 40).—At the time of going to press it is not possible to give definite information about the central feature of the Shell exhibit. However, there will be samples of Aero-Shell oil, while full information can be obtained about the Shell Carnet Service, about which Mr. H. L. Brook recently said: "... It is really amazing the trouble taken by the Shell organisation to see that everything goes smoothly."

Shell-Mex and B.P., Ltd., Shell-Mex House, London, W.C.2.

SILVERTOWN LUBRICANTS (Stand 37).—On a friction-testing machine samples of ordinary Speedolene aero oil and of Speedolene aero oil treated with "Hi-Duti" concentrate will be tested to illustrate the advantages to be obtained by thus processing a high-grade lubricant with this concentrate. The excellent lubricating properties of Speedolene are well known, yet on the friction-testing machine, which ensures boundary lubrication conditions, the addition of "Hi-Duti" will show a remarkable increase in film strength, while the initial properties of the oil will in no way be adversely affected. Under identical conditions (a Hoffmann ball bearing on a Timken ring running in an oil bath at 200° F.) the processed and unprocessed oils will be tested to demonstrate that while the unprocessed oil will break down quickly the processed oil will provide satisfactory lubrication under considerably greater load. Inspection samples will also be available.

Silvertown Lubricants, Ltd., Minoco Wharf, West Silvertown, London, E.16.

TECALEMIT, LTD.—*See under Engine Components.*

T. B.—Thompson Bros., outside, on the tarmac, will show their Mk. II refuelling tender, specially adapted for use at civil training schools. It is powered by a Ford 8 h.p. engine, and has three speeds forward and reverse, with special power take-off for pumping operations. It carries 450 gallons of petrol, in one, two, or three compartments, and 25 gallons of oil. The pumping equipment consists of meters and air separa-

tors, with efficient filtering devices. The rate of flow is 20 gallons per minute for petrol and 4 gallons per minute for oil. Control of the deliveries is effected by hand-controlled nozzles, as both supplies are fitted with necessary relief valves and venting arrangements. Special advantages claimed include extreme mobility, perfect stability, and speedy refuelling of aircraft by one man.

Thompson Bros. (Bilston), Ltd., Bilston, Staffs.

VACUUM (Stand 67).—At the time of going to press no details of this exhibit are available, but few people are unacquainted with "Green Band" and "Red Band" Aero Mobiloil, refined by the "Clearsol" process. The company also operates a carnet scheme for touring.

Vacuum Oil Co., Ltd., Caxton House, London, S.W.1.

WAKEFIELD (Stand 61) will exhibit their well-known patent Castrol lubricating oils, which are available all over the world in grades to suit every type of aero engine. In March, 1935, the firm announced this oil, of which the exclusive feature is the presence of oil-soluble compounds of chromium, $CR(C_{17}H_{33}COO)_3$, and tin, $Sn(C_{17}H_{33}COO)_2$. The chromium inhibitor protects the cylinder walls against chemical corrosion by the products of combustion, and the tin compound retards the sludge-forming oxidation of the oil in use.

To-day Patent Castrol XXL or Castrolaero C is recommended or approved by the leading aero engine makers, including Rolls-Royce, Bristol, De Havilland, Armstrong Siddeley, and such famous aircraft constructors as Avro, Handley Page, Hawker, Armstrong-Whitworth, Phillips and Powis and De Havilland, as well as the leading foreign builders.

C. C. Wakefield and Co., Ltd., Wakefield House, Cheapside, London, E.C.2.

Components, Machining, Presswork and A.G.S. Parts

ACCLES AND POLLOCK.—*See "Metals."*

AIRCRAFT MATERIALS, LTD. (Stand 53).—Since 1924, when this company first received A.I.D. approval, the metals department has built up stocks of all the latest Air Ministry specifications, and a minimum of 500 tons is always held in the London warehouses. These include carbon, alloy and stainless steels, brass and bronze alloys, Duralumin and aluminium alloys in bars, sheets and tubes. Representative specimens will also be exhibited of fork joints, shackles, rivets, bolts, screws, nuts, washers and all A.G.S. details. An additional feature will be the display of "cup," "pop" and "tubular" rivets, which are now being used in increasing quantities. A variety of riveting machines will be demonstrated in working condition. The largest is the "Aircraft" automatic riveter; it is primarily designed for "cup" riveting and, being fed by a hopper, it is claimed to be the fastest machine of its type.

Aircraft Materials, Ltd., Midland Road, London, N.W.1.

BONNELLA.—*See "Electrical Equipment."*

BROOKE TOOLS.—*See "Tools."*

BROWN BROTHERS (Stand 8).—An extraordinarily comprehensive display will include bolts and nuts in mild steel, high tensile steel, stainless steel and light alloy; pipeline fittings of all descriptions in brass, light alloy and stainless steel; screening harness tubing and fittings; flexible steel wire ropes, turnbuckles and sundry fittings; streamline wires and swaged tie-rods to British standards specifications, with associated fittings; solid and tubular rivets; metal thread and wood screws; washers of all descriptions; rubber shock-absorber cord and fittings; linen fabric and tapes, sewing thread and sundries; glues and casein cement, silver and soft solders; special machined parts to customers' requirements; and samples of mild, high-tensile and stainless steels to British standards specifications

This type of service trolley is available on loan to flying organisations using Ragosine oil.

Brown Bros., Ltd., Great Eastern Street, London, E.C.2.

E. G. BROWN (Stand 66) will stage a very representative display of sheet metal aircraft components. The company can claim many years' experience of this class of work, and among their exhibits will be air intakes, exhaust manifolds, cowlings and engine fairings, pilot seats, nose cowls, fuel tanks, oil tanks, light pressings and general sheet metal work. Visitors to this stand will also be interested in viewing a number of components riveted by the De Bergue process—a system necessitating the installation of special plant which E. G. Brown and Co. have been operating most successfully for some while.

E. G. Brown and Co., Ltd., West Road, London, N.17.

DASHWOOD (Stand 71).—As in previous years, this firm will be displaying some of the numerous accurately machined parts and components for aircraft, for which they are well known to the Air Ministry and leading manufacturers. Capstan and milling work, grinding and tool and jig making, mechanical pressed parts in high-tensile steel, etc., electric and acetylene welding, sheet metal work; all these will be represented in this firm's display of aero engine and aircraft components and armament equipment. Bomb carrying and releasing gear, fork ends for tubular struts and aero oil cocks are other productions of these specialists in precision aero engineering.

Dashwood Engineering, Ltd., Empire Works, Croydon Road, S.E.20, and 27, Grosvenor Place, London, S.W.1.

HEADLAND (Stand 20).—Sole agents in the United Kingdom, Continent of Europe, and the British Dominions for the "Dzus" self-locking fastener for cowlings, etc., the company will display examples of this accessory. They are also stockists of approved materials, A.G.S. parts, aerodrome equipment, machine shop equipment, etc.

Thos. P. Headland, Ltd., Pearman Street, Westminster Bridge Road, London, S.E.1.

EXCELSIOR MOTOR RADIATOR CO. (Stand 58) will show radiators for aircraft, including types for glycol cooling. They also make radiator parts, including brackets, outlet pipes, sumps and baffles; petrol, oil and water header tanks; sheet metal work in aluminium alloys and brass for cowlings, fairings, etc.

Excelsior Motor Radiator Co., Ltd., Oldfield Lane, Leeds, 12.

PLESSEY.—*See "Electrical Equipment."*

ROTHERHAMS (Stand 10).—This display will be representative of the firm's almost endless range of pipeline and filler cap parts and equipment. Among Rotherham specialities is a windmill or engine-driven mechanical air pump, and (an interesting new detail) a spring-loaded compression release plug intended for fitting to engines in storage so that they may be periodically "turned over" without loss of oil.

Rotherham and Sons, Ltd., Coventry.

RUBERY, OWEN (Stand 14).—Suppliers of A.G.S. parts from the inception of the industry, this firm will exhibit an assortment of aircraft components in various kinds of steels and brass, and also in Firth's Staybrite steel, together with turnbuckles, eye-bolts, bolts and nuts, shackles, fork-ends, pins and washers, etc., and all manner of A.G.S. parts; many parts are cadmium plated.

Rubery, Owen and Co., Ltd., Darlaston, Staffs.

SIMMONDS.—*See "Miscellaneous."*

VICKERS (Stand E).—From the range of Vickers Aircraft Accessories a special selection of fuel system fittings will be shown. These have become a standard part of the equipment of the great majority of aircraft of all types, both Service and commercial. The exhibit will include Vickers two-, three- and four-way fuel-cocks, two- and three-way oil cocks, in Dural and brass, non-return valves (horizontal and vertical types), fuel filters and pumps. An additional item will be an example of the Vickers oleo-pneumatic shock-absorber strut, assembled and in detail. This has been specially designed to meet the demand of the latest types of braked and retractable undercarriages.

Vickers (Aviation) Limited, Vickers House, Broadway, London, S.W.1.

WRIGHTS' ROPES (Stand 46) will be exhibiting types of steel cables suitable for aircraft. These cables are spun from finest British steel to comply with such specifications as 3W6, 5W2, DT, 181A, DTD, 236, etc. Cables can be supplied with suitable fittings if desired, while a speciality is made of non-corrodible cables and strands. Also exhibited will be a representative selection of steel ropes as supplied to all branches of industry.

Wrights' Ropes, Ltd., Birmingham, 9.

Metals, Castings, Extrusions, Etc.

ACCLES & POLLOCK (Stand 24).—This display will centre on a fully equipped tubular drawing office table with chair and stool. On the left of the drawing board there is a side reference table, and on the right a table where full-sized prints can be laid out for reference. This is equipped with drawers. Displayed on the table will be examples of 2.T.2. tubes bent and sectioned on the bend to illustrate the gathering and thinning of the metal on the inner and outer walls respectively. Similarly there will be shown Gloster Gladiator undercarriage legs sectioned to show the accuracy to which these are machined. There will also be examples of welded structures made from steel tubing; exhaust collector pipe made from stainless sheet and stainless steel tube; capillary tubes and high-pressure tubes for instrument work; examples of pressure-filled jacket rings made from A. and P. tubing by the Wills Pressure Ring Co.; and one or two examples of exceptional tube manipulation made for use in connection with hydraulic retracting gears, etc.

Accles and Pollock, Ltd., Oldbury, Birmingham.

BIRMINGHAM ALUMINIUM CASTINGS (Stand 76).—This exhibit will consist of

aluminium alloy sand and die castings in heat-treated and normal alloys for aero engine and aircraft components and small fittings; Elektron magnesium alloy castings, heat-treated and normal (the company's range of castings in aluminium and Elektron alloys includes crankcases, cylinder heads, volutes, covers, pipes, tappet guides, diffusers, tail-wheel forks, heater valves, hand wheels, cable clamps, pedals, etc.); examples of wrought construction in high-tensile aluminium alloy sheet and sections, including a leg bracket for fairing and a sliding door; and an exhibit of Birmabright alloy, resistant to corrosion, for cast and wrought purposes. This last will include typical examples of the alloy as applicable to the construction of engines and airframes in various finishes, including approved anodic finish.

Makers: Birmingham Aluminium Castings (1903) Co., Ltd., Smethwick, Birmingham.

JAS. BOOTH (Stand 78).—The display of James Booth and Co. will comprise an extensive range of wrought non-ferrous alloy products. Among these the alloy Duralumin is so well known that it will hardly need description. The aluminium-coated form of this material possesses an exceptional resistance to corrosion. Among the more recent magnesium aluminium alloys are MG7 and D.2. Both possess a very high resistance to corrosion by sea water, the former having a strength almost equal to that of Duralumin. Since D.2 possesses considerable ductility it is specially suitable for the production of deep pressings or sheet metal work generally. Elektron, which is 40 per cent. lighter than aluminium will be shown prominently in its various forms. A specially interesting exhibit will be the range of c.p. airscrew blade hot pressings, both in Duralumin and Elektron. There will also be shown a variety of forms of the brass and copper productions of the company.

Makers: James Booth and Co. (1915), Ltd., Nechells, Birmingham, 7.

ENGLISH STEEL CORPORATION (Stand 62) will make an attractive display of small tools, files, hacksaws and tool steels in specially designed cabinets. Finished drop-forged crankshafts, hubs and flanges, and other aircraft components and precision-ground bar (round and hexagon) will also be shown. Three large photographs, specially coloured and illuminated, will give an excellent idea of the heavy steel products made at Vickers Works, Sheffield. These will illustrate the melting department, heavy forge and machine shops, which can deal with ingots up to 250 tons in weight, and forgings up to 160 tons.

Makers: English Steel Corporation, Ltd., Vickers Works, Sheffield.

THOS. FIRTH (Stand 12).—A range of the well-known alloy steels supplied by this company to the leading aircraft companies will be on view on this stand. These will take the form of ground steel bars, illustrated by examples, showing the careful inspection which is carried out through all manufacturing processes, a range of engineers' small tools, including those supplied for airscrew manufacture, "Speedicut" blades, easy slow spiral drills for high-tensile sheet, Nitralloy sheets for templates in ¼in. gauge, milling cutters, "Diehard" and "Millenicut" files, "Speedicut" high-speed steel, airscrew hub stampings and a number of engines and parts, as supplied by the leading aircraft manufacturers, made from Thos. Firth steel.

Makers: Thos. Firth and John Brown, Limited, Atlas and Norfolk Works, Sheffield.

FIRTH-VICKERS STAINLESS STEELS (Stand 7) will display the various forms in which non-corrodible steels are supplied for aircraft construction. The steel products of the company may be divided roughly into three groups: the "Staybrite" group (8 per cent. nickel, 18 per cent. chromium); the 2 per cent. nickel, 20 per cent. chromium (S.80) group, and the 12 per cent. chromium steel group. A special exhibit, taking the form of a display board, clearly shows how sheets, strips, bars, drop stampings, tubes and wire of different tensile strengths and belonging to the different families of steels are inter-related as regards chemical analysis and mechanical properties.

Makers: Firth-Vickers Stainless Steels, Limited, Staybrite Works, Sheffield, 9.

W. T. FLATHER (Stand 5).—This display will comprise a set of micro-photographs showing steel in various forms, together with a full set of release notes showing typical tests obtained. There will also be a number of fully machined parts produced from steels of their manufacture.

Makers: W. T. Flather, Ltd., Standard Steel Works, Sheffield.

SAMUEL FOX (Stand 84) will show examples of stampings and components made from their steel. These include such important parts as crankshafts, master and articulated connecting rods, cylinders and many smaller articles forged by Thos. Smith's Stamping Works, Ltd., The Hughes-Johnson Stampings, Ltd., Geo. Turton, Platts, Ltd., and Smith Clayton Forge, Ltd., with whom Samuel Fox work in close co-operation in the supply of aero engine and aircraft parts. Centreless ground bars of ½in. to 2in. diameter will also be among the items shown. For purposes where the requirements of the user are particularly stringent attention is drawn to the "Diamet" code of inspection, designed to ensure the highest possible standard of cleanness and regularity in the electric steels made by the company.

Makers: Samuel Fox and Co., Ltd., Stocksbridge Works, near Sheffield.

HABERSHON (Stand 3) will be showing samples of stainless and alloy steels in sheet and strip form, which they manufacture to most of the Air Ministry specifications. In addition, they will display a board on which will be a number of the sections made up from their steel as used in the construction of very many of the modern aeroplanes today.

J. J. Habershon and Sons, Ltd., Rotherham, Yorks.

HIGH DUTY ALLOYS (Stand 42) are manufacturers of the "Hiduminium R.R." series of high-tensile aluminium alloys, and will show a comprehensive range of castings, forgings and stampings in their materials. Heads, barrels, pistons, blocks, connecting rods, crankcases, supercharger rotors, etc., are shown as typical of the many applications of "Hiduminium" alloys to the engines of such firms as Armstrong Siddeley, Bristol, Cirrus, De Havilland, Napier, Pobjoy, Rolls-Royce, and many of the Continental manufacturers. Also exhibited are examples of a stamping and a finished blade for the De Havilland c.p. airscrew. A group of castings and stampings in the "Magnuminium" series of magnesium-base alloys, of volute casings, timing covers, tappet guide locating rings, breather pipe flanges, etc., will also be exhibited. Of particular interest will be a full-length airscrew blade stamping in magnesium alloy. These are produced by High Duty Alloys' associate company, Magnesium Castings & Products, Ltd.

High Duty Alloys, Ltd., Slough, Bucks.

I.C.I. (METALS) exhibit (Stand 57) will include strip and sheet aluminium alloys to appropriate D.T.D. and B.S.I. specifications; radiator tubes in cupro-nickel and brass; brass rod and brass sections; brass and phosphor bronze wire for controls; brass sheet and strip for water and petrol tanks, etc.; copper piping for oil and petrol feeds; and small parts such a brass nuts, bolts and pressings for fire extinguisher bodies.

Makers: I.C.I. (Metals), Ltd., Kynoch Works, Witton, Birmingham, 6.

NORTHERN ALUMINIUM (Stand 38).—Aluminium and its alloys in sheet form will be displayed and will include the high-tensile alloys in both the "straight" and "Alclad" forms. The latter product will also be exhibited in examples of components. In particular, its formability will be shown by complicated pressings and flanged units, and the simplification of construction due to the elimination of anodic oxidation will be clearly seen in the sub-assemblies on show. Standard anodic finishes on pure aluminium and alloy sheets will also be on view. A representative selection of rod, bar and extruded sections will be shown in the most widely used alloys. The production of the company's Birmingham foundry will be represented by castings including that of a cylinder head, while the latest developments in special foundry alloys are shown by pistons and cabin fittings, the latter anodised. As a pigment for aeroplane dope, Noral aluminium paste will be exhibited.

Makers: Northern Aluminium Co., Ltd., Banbury, Oxon.

REYNOLDS TUBE (Stand 9).—In steel there will be examples of the firm's well-known seamless steel tubes to all specifications, particularly tappet rods, and a variety of manipulated tubes, bent, trapped and pierced, etc., for all aircraft purposes. In aluminium alloy the visitor will find a large variety of extruded sections. Examples shown will be representative of those now being supplied for the majority of machines at present in production, including the Empire boats, Battle, Lysander, etc. There will also be manipulated sections for engine rings and brake shoes, manipulated tubes and taper gauge tubes in extra long lengths.

Makers: Reynolds Tube Co., Ltd., Tyseley, Birmingham.

STERLING METALS (Stand 32).—This exhibit will include castings, aluminium alloys, sand and permanent mould, and aluminium alloy forgings. The company will make a special feature of Elektron magnesium castings, sand- and permanent-moulded, including machined and polished items and Elektron magnesium alloy forgings. Photographs of their various products will be available and will be shown together with micro-photographs and X-ray specimens. Technical data will be available, and the exhibit will include the first magnesium ingot made in England, by Magnesium Elektron, Ltd., Clifton, Lancs. All the magnesium examples shown on the stand will be made from British-made ingot by Magnesium Elektron, Ltd.

Makers: Sterling Metals, Ltd., Coventry.

J. STONE (Stand 91).—On this stand will be found castings, die-castings, and forgings in Ceralumin aluminium alloy to D.T.D. specifications, and castings and die-castings in Elektron, also to D.T.D. specifications. A new bearing alloy will be exhibited which is known as Chromium Bronze C.B.F., and is a *wrought* alloy. It has extremely good bearing properties combined with the capacity for being hot-worked in a variety of ways. Other exhibits will include various types of rivets and washers used in aircraft construction, and a variety of castings and finished parts in non-ferrous alloys.

Makers: J. Stone and Co., Ltd., Deptford, London, S.E.14.

Tools, Plant, and Works Equipment

AVERY (Stand 25).—A machine of particular interest will be the Avery-Brownsdon wear tester, which enables wear problems to be approached directly by the measurement of wear instead of indirectly by the measurement of friction. The method of operation consists of bringing a flat stationary sample of one metal into frictional contact with the periphery of a rotating wheel of another metal under known conditions of speed and dimensions of the wheel, load, temperature, lubricant and duration of test. The impression so made in the flat sample of metal is then taken as a measurement of wear, much in the same way as the impression of a ball or cone penetrator is taken as a measurement of hardness. Another Avery machine to be exhibited has been specially designed for determining the Rockwell hardness of materials during production. A direct numeral reading is given. The balance of airscrews is accurately determined by a third machine to be exhibited on this stand. Also exhibited will be a balancing machine for engine connecting rods. This consists of two steelyards which are balanced off with a standard connecting rod until zero is shown by the two auto-

matic indicators. Rods to be tested are then inserted in the machine and the amount of overweight at each end is shown.

Makers: W. and T. Avery, Ltd., Soho Foundry, Birmingham.

BROOKE (Stand 89).—As at each Show in the past, this company's display of machined components, together with their well-known tool specialities, should prove exceptionally interesting to those engaged on engine and aircraft production. The answer to most machine shop problems is better and still better tools. Prominently displayed will be milling cutters of all types (particular attention being drawn to "Cardinal" patent cutters), drills, reamers, counterbore sets, saws, machine vices, tappers and a full range of "Cardinal" patent drill chucks. The company also maintain a jig and fixture design service and claim to be the largest manufacturers of high-precision jigs and fixtures serving the industry.

The Brooke Tool Manufacturing Co., Ltd., Cardinal Works, Greet, Birmingham, 11.

CANNING (Stand 19).—Examples of five processes of electro-deposition will be shown, as follows: (1) Anodic oxidation, which is being employed for the protection of aluminium components in aircraft construction; it produces a thick, firmly adherent film of oxide on the aluminium, and is worked by making the metal the anode in a bath of dilute chromic acid, and using a stainless steel cathode. Anodic oxidation has a marked influence on bending tests, enlarging the permissible radius while not materially affecting the tensile strength. (2) Cadmium plating, the well-known method of rust-proofing iron and steel, exceptionally resistant to atmospheric corrosion. (3) Nickel plating, the process found necessary to protect exhaust manifolds and the outsides of air-cooled cylinders. (4) Chrome plating, as a protection against abrasion. (5) Chromating of magnesium and Elektron parts.

W. Canning and Co., Ltd., Great Hampton Street, Birmingham, 18.

DESOUTTER BROS. (Stand 18) are to show an extremely comprehensive range of both pneumatic and electric tools, each one having some distinctive feature. The "Mighty Atom" pneumatic drills are well known to the aircraft industry as a whole, which is only as might be expected since they were specially designed for this market. The very low air consumption, which, it is claimed, no other pneumatic tool can approach, is due to care in design and accurate workmanship in production, whilst the power obtained is equal to that of many tools of twice their size. Recent additions to the range which are, perhaps, not quite as well known, are shear and tapping machines. A distinctive feature of the electric tools is their high power-weight ratio, coupled with excellent workmanship and design, which ensures freedom from frequent annoying breakdowns. Apart from the small electric drills referred to, this firm is also exhibiting some of their larger models, and a particularly interesting tool is a bench grinder.

Desoutter Bros., Ltd., The Hyde, Hendon, London, N.W.9.

ENGLISH STEEL CORPORATION.—*See under Metals.*

THOS. FIRTH.—*See under Steels.*

GILMAN (Stand 47).—Flexible shaft drives and allied equipment are largely employed during the course of manufacture of aircraft engines, being used for grinding, dressing and fettling aluminium, steel, etc. Such drives are specially employed for dressing castings. The flexible shafts are also used for operating speed indicators and other instruments where distant control is required. Flexible shafts are very useful for drilling in awkward places during airframe construction, and similar equipment is frequently employed for general repair work, decarbonising, etc., of aircraft engines. A special flexible shaft operating a metal-shearing attachment can be supplied for cutting shapes out of sheet metal.

F. Gilman (B.S.T.), Ltd., Carlton House, High Street, Smethwick, Staffs.

Miscellaneous

AERO AND PANEL PLYWOOD (Stand 21).—At the time of going to press no details of this exhibit are available. They are, however, suppliers of a wide range of aero plywood, and shaped sections to order.

Aeronautical and Panel Plywood Co., Ltd., 218-226, Kingsland Road, London, E.2.

BURGESS (Stand 55).—Quiet operation is now recognised as a hallmark of mechanical efficiency, and Burgess Products Co., Ltd., will show a group of exhibits illustrating the latest methods of eliminating unwanted noise. These include: (1) Burgess Acousti-Pad, the modern sound absorbent, which consists of Acousti-plate backed with sound-absorbent material. It is vermin- and dust-proof and fire resistant, and is available in a variety of finishes for ready application to any sound-reflecting surface. (2) Burgess Dedenet, a lightweight, flexible material originally developed by the C. F. Burgess Laboratories, Inc., for the elimination of body resonance and the prevention of panel drumming. (3) Burgess "Straight-Through" Silencers, constructed in accordance with the well-known Burgess principle of acoustic silencing. (4) Burgess - Farnborough Silencers, a new design which combines lightness of weight with a close control of back pressure and silencing efficiency. (5) Burgess Acousti-Booth, for use in noisy workshops as a telephone or conversation booth. Other exhibits, not included in the category of acoustic products, will include the Burgess air filter element for petrol and oil engines and the Burgess-Noveto vice.

Burgess Products Co., Ltd., Barwell, near Leicester, and Thames House, Millbank, London, S.W.1.

THE E.S.A. (Stand 39) are to exhibit large photographs of the work they have done, including hangars fitted with "Esavian" doors as far back as 1918 at Henlow, and the hangars at Speke erected in 1936, with a photograph of doors which have been erected at Hatfield itself. In addition, there will be a photograph of the electric motor which works the large doors at Filton Aerodrome, Bristol, and Speke Aerodrome, Liverpool, and a working model of a hangar fitted with the electrically operated folding and sliding Esavian doors. Outside, on the tarmac, will be erected two pairs of leaves of an Esavian door 19ft. high, fitted with a full-size electric motor as used for working the 35ft. x 200ft. doors at Filton and Speke.

The Educational Supply Association, Ltd., Esavian House, 171-181, High Holborn, London, W.C.1.

FLIGHT
AIRCRAFT ENGINES AND AIRSHIPS
STAND 37a

GENERAL FIRE APPLIANCE (Stand 15).—At the time of going to press no details of this exhibit are available. The company makes a number of types of fire extinguisher and allied equipment specially suitable for use on aerodromes and aircraft.

General Fire Appliance Co., 11, Queen Victoria Street, London, E.C.4.

IRVIN (Stand 13).—These well-known makers of parachutes will feature four items. First there will be an Irvin back-type parachute incorporated in an aeroplane chair upholstered by Rumbolds. The parachute is completely hidden except for the shoulder straps. In emergency it is necessary only for the wearer to slip his or her arms through the straps, fasten the breast and leg strap snap hooks, and tighten the leg strap by means of the webbing "pull." The upholstery comes away with the parachute and acts as cushions to the harness. Secondly, there will be shown the Irvinsuit of reversed lambskin for high-altitude and cold-weather flying. This suit has been thoroughly tested out at temperatures of many degrees below zero, and takes the place of electrically heated clothing. Lastly, there are the standard Irvin seat-type quick-release parachute for pilots and quick-connector, quick release parachute for observers, as used by the British Air Force and many other air forces and private owners throughout the world.

Irving Air Chute of Great Britain, Ltd., Icknield Way, Letchworth, Herts.

R. & J. PARK (Stand 48).—Here will be found an information bureau dealing with all overseas enquiries. R. & J. Park state that they will be very pleased to give information regarding the cost of shipping aircraft, etc. Estimates for the inclusive cost of packing and shipping complete aircraft, also engines and accessories, to any part of the world will be given on request. The Company also manufactures special types of packing cases for airscrews, engines, etc.

R. and J. Park, Ltd., Sackville House, 143-9, Fenchurch Street, London, E.C.3.

PITMANS (Stand 22).—At the time of going to press no details of this well-known publishing company's exhibit are available. It may be assumed, however, that it will indicate the amazingly comprehensive range of Pitman text-books on almost every imaginable aspect of aviation and aeronautical engineering.

Sir Isaac Pitman and Sons, Ltd., Parker Street, London, W.C.2.

SIEBE, GORMAN (Stand 86).—The aviation section of this old-established firm will feature oxygen breathing apparatus for high-altitude flying; pumps for filling oxygen cylinders; air cylinders; safety belts; collapsible dinghies; and test apparatus for aircraft instruments.

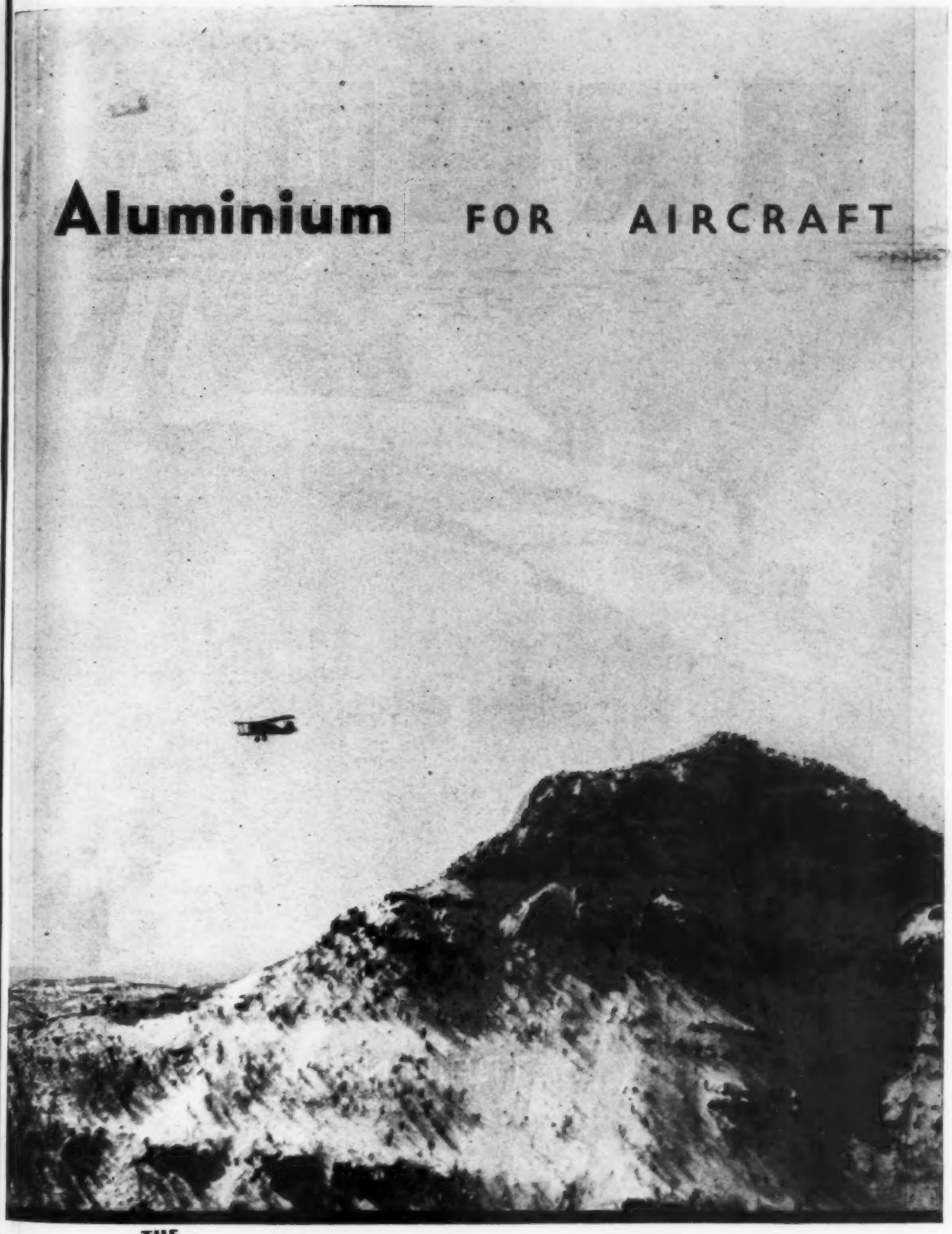
Siebe, Gorman and Co., Ltd., 187, Westminster Bridge Road, London, S.E.1.

SIMMONDS AEROCESSORIES (Stand 45) will show a complete range of the various types of nuts manufactured by them, including the floating anchor nut, detachable anchor nut, and the strip nut, all of which are recent developments of particular interest. The self-locking properties of the Simmonds Elastic Stop Nut will be demonstrated on a special vibrating machine. The flexibility of Simmonds controls will also be demonstrated on a working model. These controls are now employed by over sixty aircraft manufacturers. A very complete range of Simmonds-Goudime Navigational Instruments will be exhibited, including the type "F" four-vector, type "E" automatic course and double drift, type "D" course and double drift, and type "C" course and distance calculators. Amongst other exhibits, the following Simmonds specialities should be mentioned:—Wondegrip non-slip aircraft flooring; cowling clips; self-centering bushes; flexiclips; jointing compound.

Simmonds Aerocessories, Ltd., Shell-Mex House, London, W.C.2.

WILLIAMSON CAMERAS (Stand 88).—The Williamson Manufacturing Co., Ltd., will be exhibiting samples of their complete range of aircraft cameras, as follows:—(1) Eagle III Camera, size 5in. x 5in. (12.7 cm. x 12.7 cm.).—A general-purpose camera for hand-held oblique photography or for military reconnaissance or vertical survey work. It is fully automatic in action and control, either with electric or airvane drive. The magazine has a capacity of 115 exposures. (2) Eagle IV Camera, size 7in. x 9in. (18 cm. x 24 cm.).—Fully automatic camera for air survey or military purposes. Driven by self-contained electric motor, with detachable lens cones capable of accommodating lenses of any focus. The capacity is 200 exposures. (3) Cine-Gun Camera, by which a cinematograph record of air combat practice shooting is obtained, together with an image of a watch at the end of each burst of fire. (4) Camera Gun Type G.22.—A stop-watch is automatically recorded on every photograph. Standard 2½in. (6 cm.) wide film is used in quickly and easily replaceable holders. A special daylight developing outfit is supplied which enables results to be demonstrated immediately to pilots whilst the exploits are fresh in their minds. Both this and the Cine-Gun can be supplied either as observer-type guns or as fixed guns operated by the pilot. (5) Pistol Camera, size 3¼in. x 2¼in. (9 cm. x 6 cm.).—A hand-held, pistol-shaped camera for pictorial photography.

Williamson Mfg. Co., Ltd., Litchfield Gardens, London, N.W.10.



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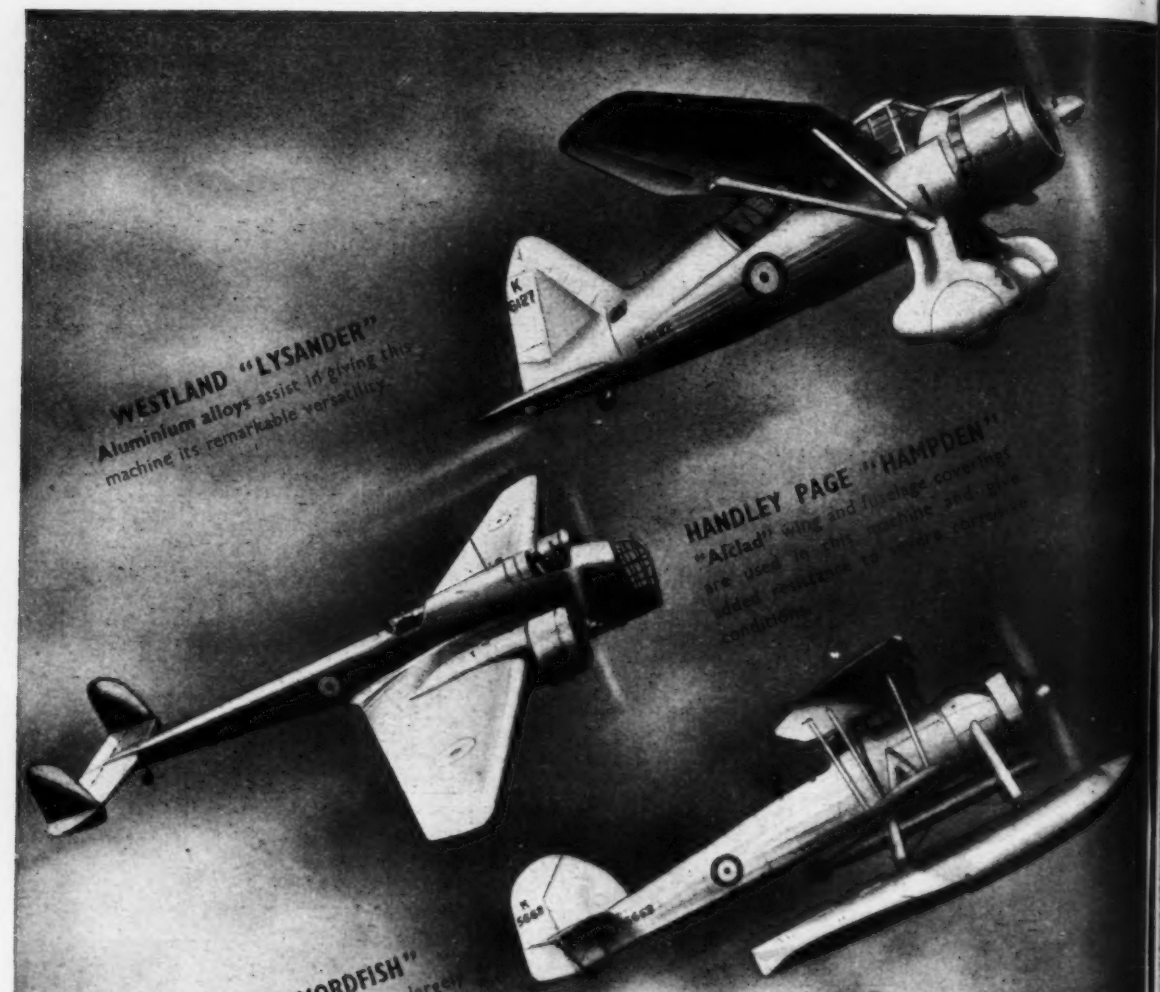
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A hundred years ago going abroad was a thrilling and often uncomfortable adventure.

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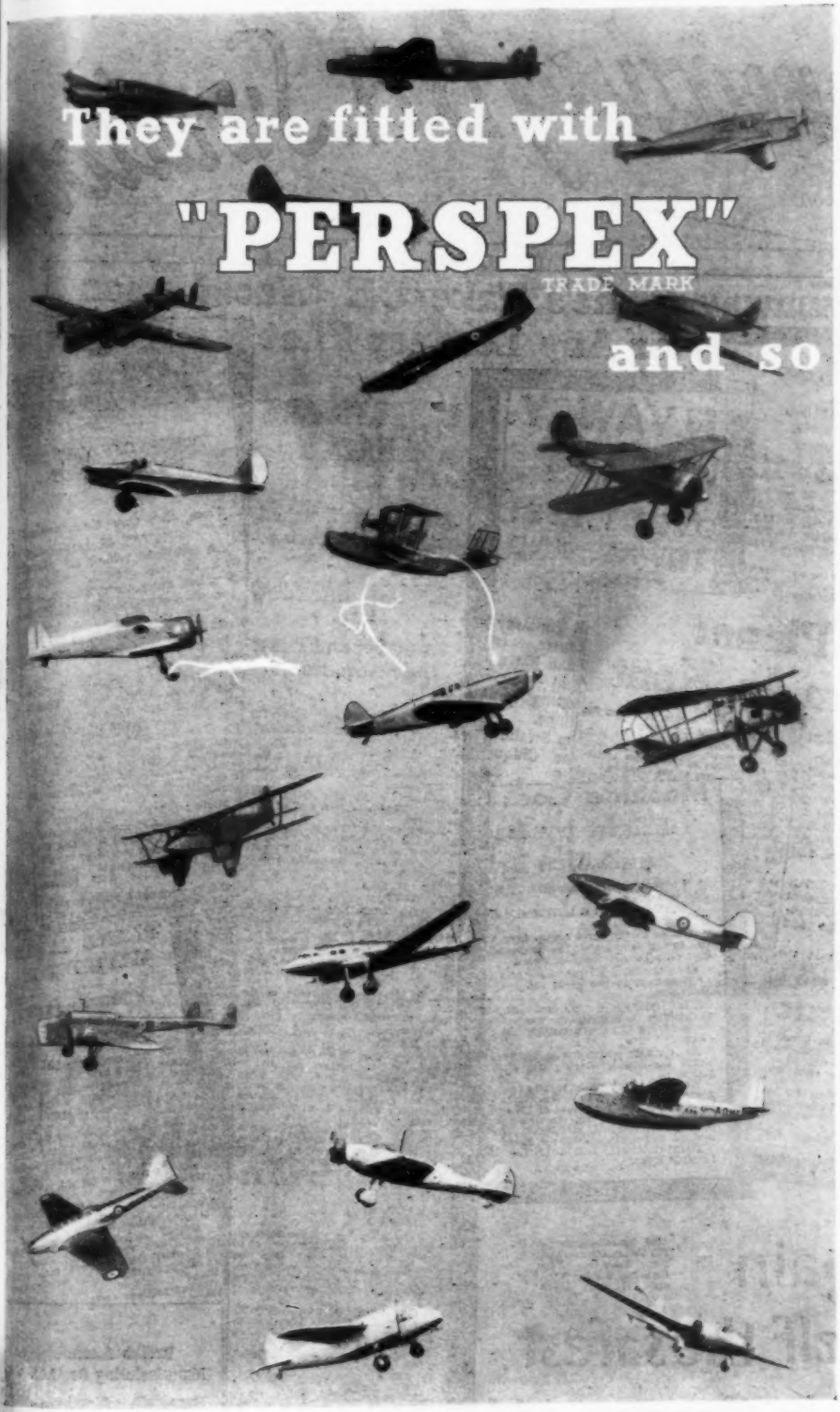

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The amazing B.A. Swallow

THE STAR, SATURDAY, JUNE 5, 1937

Runaway Plane's Take-Off Was Lesson for Any Learner Pilot

EXPERTS ARE AMAZED

Should Have Crashed, By All The Rules

PERFECT BANKING

Circled Several Times Over Aerodrome

IT will be a long time before the members of the Cinque Ports Flying Club at Hythe, in Kent, cease to talk of the uncanny, pilotless flight of their little Swallow.

Learners loved this little two-seater. It was so safe, and so easy to control.

To-day on the fringe of the Hawkinge R.A.F. aerodrome it lies, a wreck as to the fuselage, but with its engine still intact except for a bent crankshaft.

THEY LOOKED FOR PILOT

Without human help it flew for 35 minutes, attained a height of a thousand feet, went eight miles in a straight line and a much greater distance if its turns are taken into account, and finally gave the R.A.F. men at Hawkinge a high-powered shock.

They raced an ambulance to the field where the 'plane crashed and looked in vain for a pilot.

THEORY AT THE CLUB

A Cinque Port Flying Club member said to a "Star" reporter to-day:

"An amazing flight. No other 'plane, I believe, has ever run away, pilotless, as G-AEVC did, cleared the aerodrome and very nearly landed on its own.

"Our theory is that the 'plane was nicely 'trimmed,' as to its controls, before it took the bit between the teeth, so to speak. Nicely rigged, it leaped into the air instead of nose-diving, as it should have done by all the rules.

TOOK OFF IN CROSS-WIND

"I saw it happen. It was most extraordinary. It actually took off in a cross wind, then swung into the wind, banked beautifully on the turn, circled several times—hasn't it, a promising pupil couldn't have done it better.

"Anyone standing immediately below and not knowing the circumstances would have sworn there was a fellow in the cockpit.

"The British Aircraft Manufacturing Co. at Hanworth (makers of the machine) were greatly interested to hear of the strange flight.

They claim that the B.A. Swallow is the simplest and most reliable machine of its type in the world.

PILOTLESS 'PLANE ESCAPES FROM AIRPORT

TAKES OFF DURING GROUND TEST

From Our Own Correspondent

HYTHE (Kent), Friday.

An aeroplane taking off to-night with no one aboard, performing loops and dives, turns and spins for 35 minutes over Lympne and Hythe, and then crashing into a tree at Hawkinge, provided one of the most amazing accidents in the history of British aviation.

The machine, a Klemm Swallow monoplane belonging to the Cinque Ports Flying Club, was being tested by a mechanic outside the club's hangar at Lympne. The throttle became jammed and, knocking the mechanic aside, the 'plane raced across the aerodrome, climbed into the south-wind, and rose to a height of about 200 feet.

Air Ministry officials, club officers, and police from the R.A.F. squadrons rushed to watch its evolutions as it circled the aerodrome three times, narrowly missing a beacon on one occasion. Then it disappeared over the hills towards Dover.

Urgent calls were put through to police stations in Folkestone, Sandwich, Deal, Canterbury, Ashford, Dover, Hythe, Romney, Lydd, Rye, Tenterden, Hastings, and other Kentish towns, asking them to watch for the 'plane, which was described as being without sufficient petrol for more than an hour's flying.

For three hours the 'plane circled over the aerodrome and the surrounding country, and then, apparently having exhausted its petrol supply, it dived to earth.

'PLANE TAKES OFF WITHOUT PIL

FLEW 35 MINUTES

From Our Own Correspondent

HYTHE, Fr

An uncontrolled and pilotless plane, which flew over Lympne and Folkestone to-night for 34 m before it eventually crashed into at Hawkinge, caused alarm in the towns.

The 'plane, a Klem Swallow belon to the Cinque Ports Flying Club, being started at Lympne outside the hangar at 8.40. The propeller swung, the engine started, and then throttle jammed.

There was a roar, the monoplane ra across the aerodrome and climbed t height of about 200 feet.

Officials raced out as the pla banked and turned, dived, rose aga and circled the aerodrome three time It disappeared over the hills towar Dover.

Police stations at ...

RUNAWAY AEROPLANE

PILOTLESS MACHINE'S 35-MINUTE FLIGHT

FROM OUR CORRESPONDENT

FOLKESTONE, JUNE 4

A Klem Swallow aeroplane, belonging to the Cinque Ports Flying Club at Lympne, made a remarkable flight to-night without a pilot, being in the air for about 35 minutes before it crashed some miles from the point where it took off.

Shortly before 9 o'clock the aeroplane was being attended to by a member of the ground engineering staff when the propeller swung

FLYAWAY PLANE

OVER THREE TOWNS—AND ...HES

...s runaway ...capers over ... and Folke- ...ght — and ...shing into ...inge.

...m Swallow ...e Cinque

Pilotless Plane: Alarm In Kent

From Our Own Correspondent

HYTHE, Friday.

THREE towns and several villages watched the sky in panic to-night while a pilotless flyaway plane banked and swooped for 35 minutes over Lympne and Hythe, circled the Cinque Ports Flying Club aerodrome three times, and then flew off over the hills.

As it vanished, club officials rushed to the phone, put urgent calls through to police headquarters at Dover, Hythe and Folkestone.

Fire brigades, fearing that the plane would crash into a house, stood by in these towns, ready to race to the rescue.

But the runaway crashed into a tree at Hawkinge, eight miles away from the aerodrome, and was wrecked.

The plane an open cockpit Kleman Swallow belonging to the club—was being started outside the hanger by an engineer, when the engine burst into life with a roar.

Then, as the engineer leapt for his life, the plane tore across the aerodrome and climbed to a height of about 200 feet.

Astonished officials, rushing from offices, saw it bank, turn, dive and rise again as it circled the drome.

Another machine immediately took off in pursuit. The runaway was, however, flying as though an accomplished pilot was at the controls.

The mach... one dist... direction... Officer... aerodro... ing wi... but no...

Sudd... swoop... mess... wrong... to w...

Th... circl... than... grou...

Machine Goes ... Flight by Its ... and Fire Bri...

AN aeroplane flew off without pilot yesterday.

For 35 minutes it banked and c... Folkestone while

Police in the three towns were b... by. It was feared that the 'plane mig... dive on a thickly-populated area.

Then the machine crashed into a t... at Hawkinge to the great relief of t... authorities.

The 'plane, a Klemm Swall... monoplane belonging to the Cinq... Ports Flying Club, was outside the cl... hangar.

An engineer swung the propeller a... when the engine started the throt... jammed.

With a roar the 'plane raced across t... aerodrome, climbed into the south-we... wind and reached a height of 200 feet.

Officials rushed out as the 'plan... banked and turned, dived and circle... around the aerodrome three times.

Then it disappeared over the hil... towards Dover.

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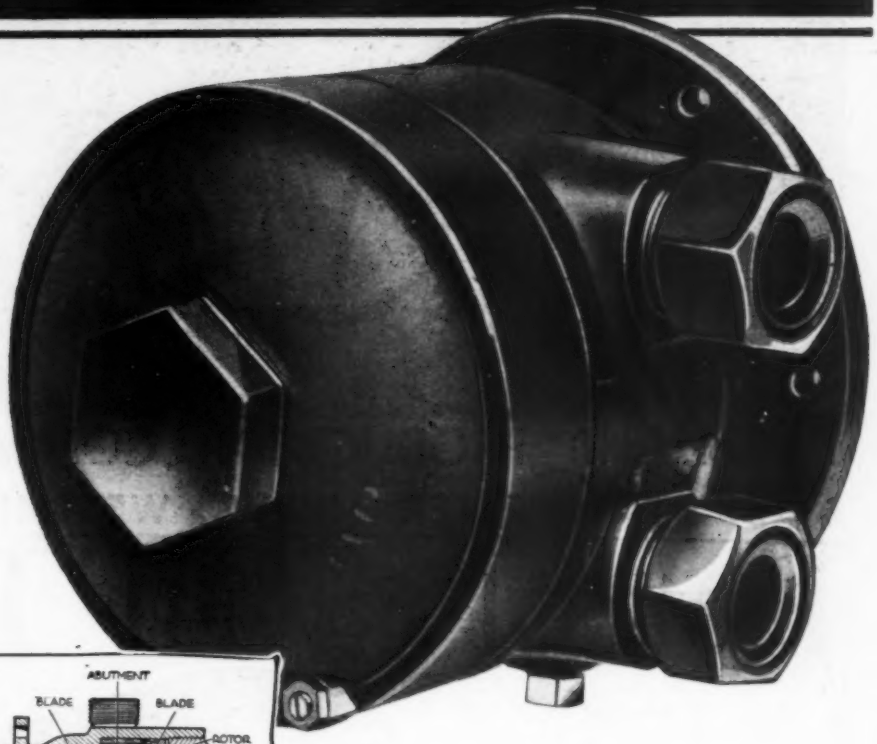

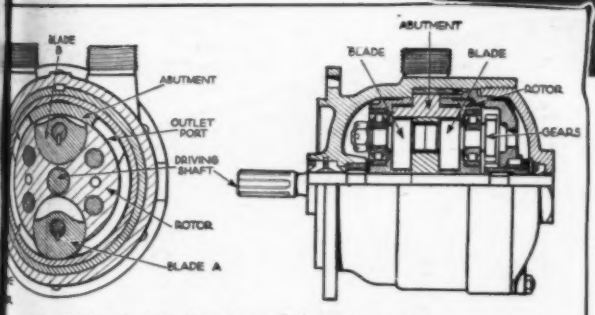

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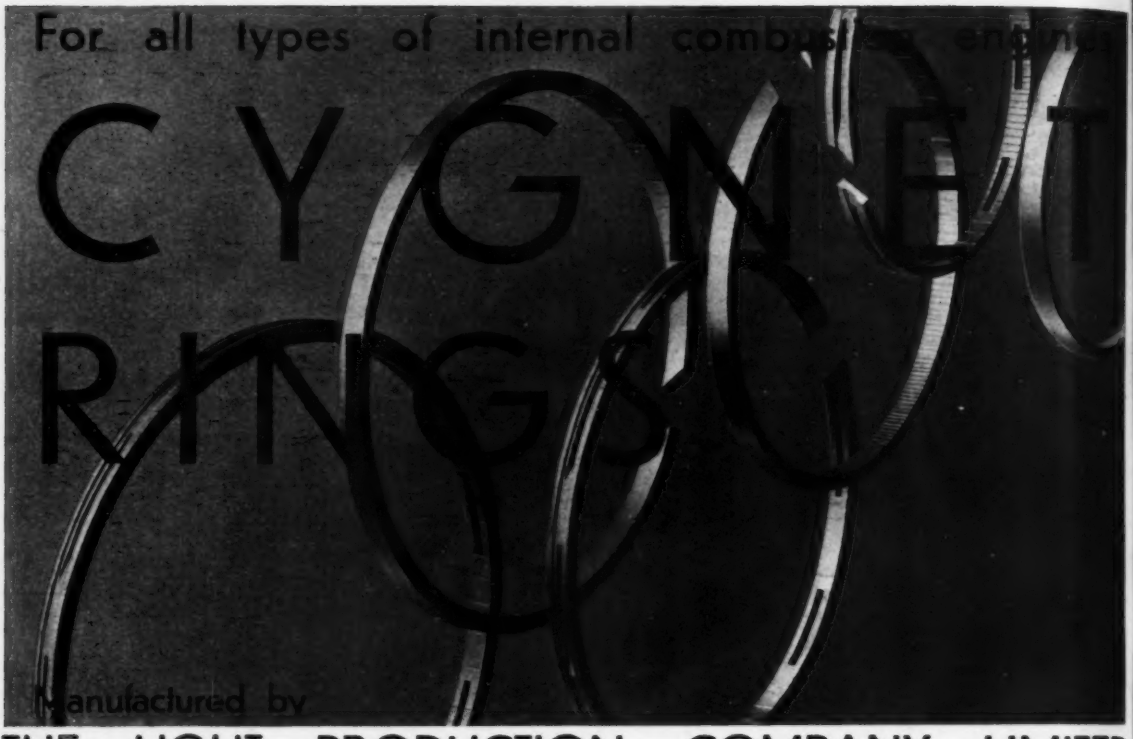

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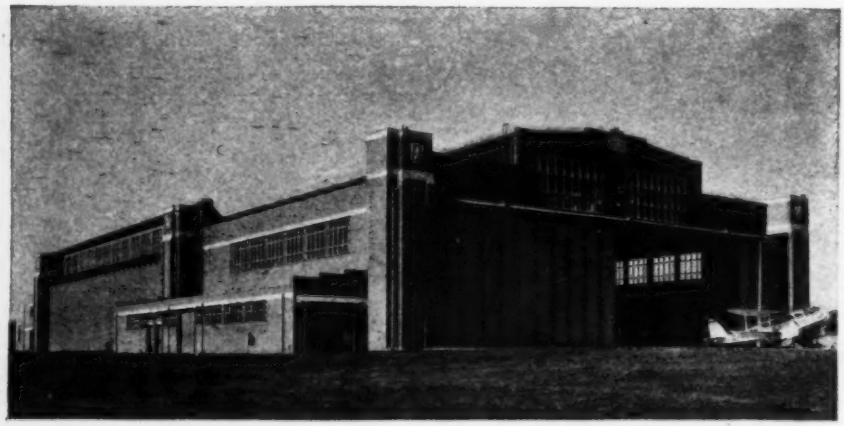

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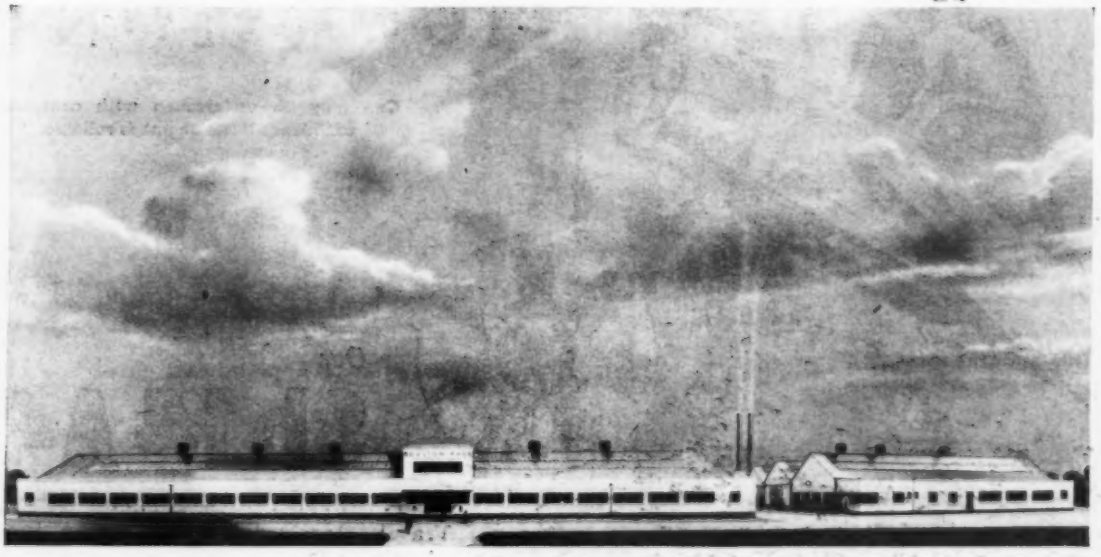

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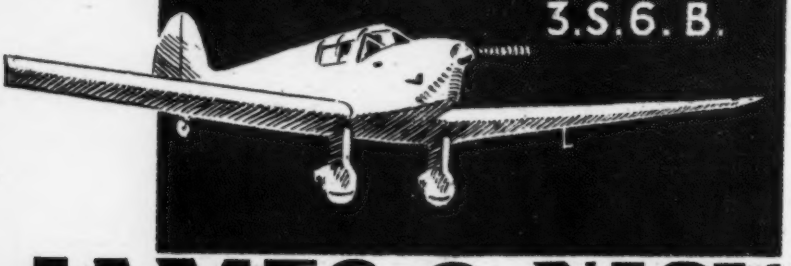

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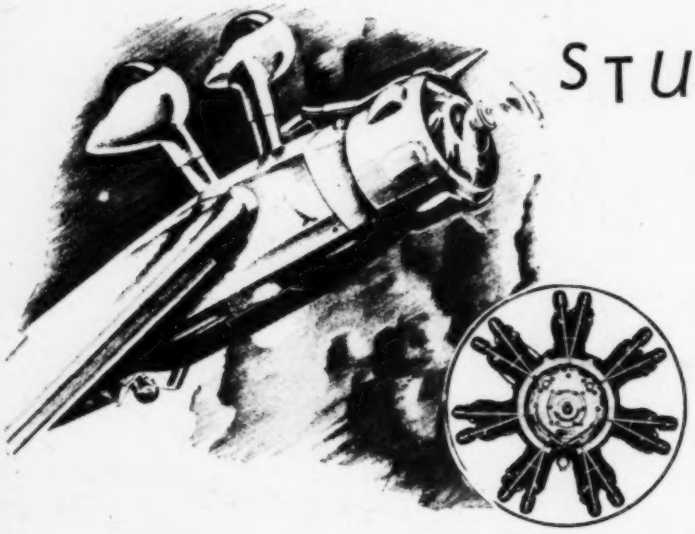

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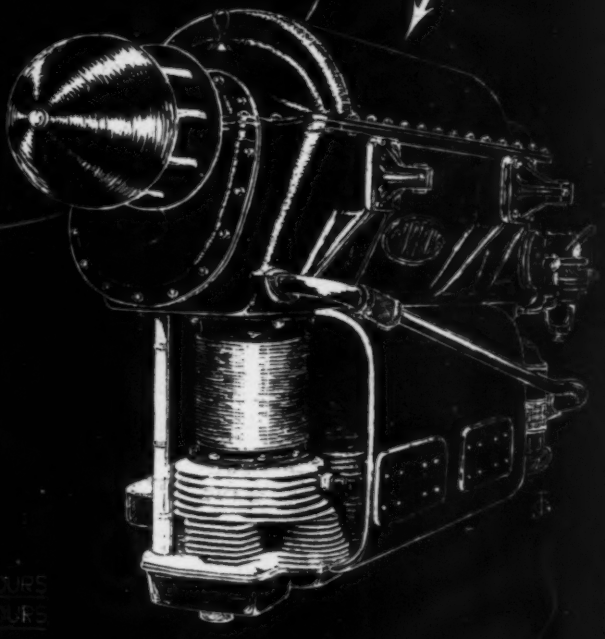

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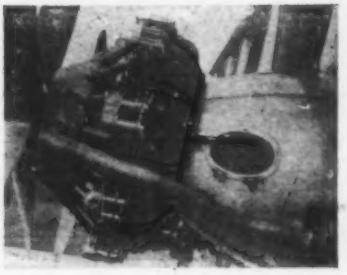

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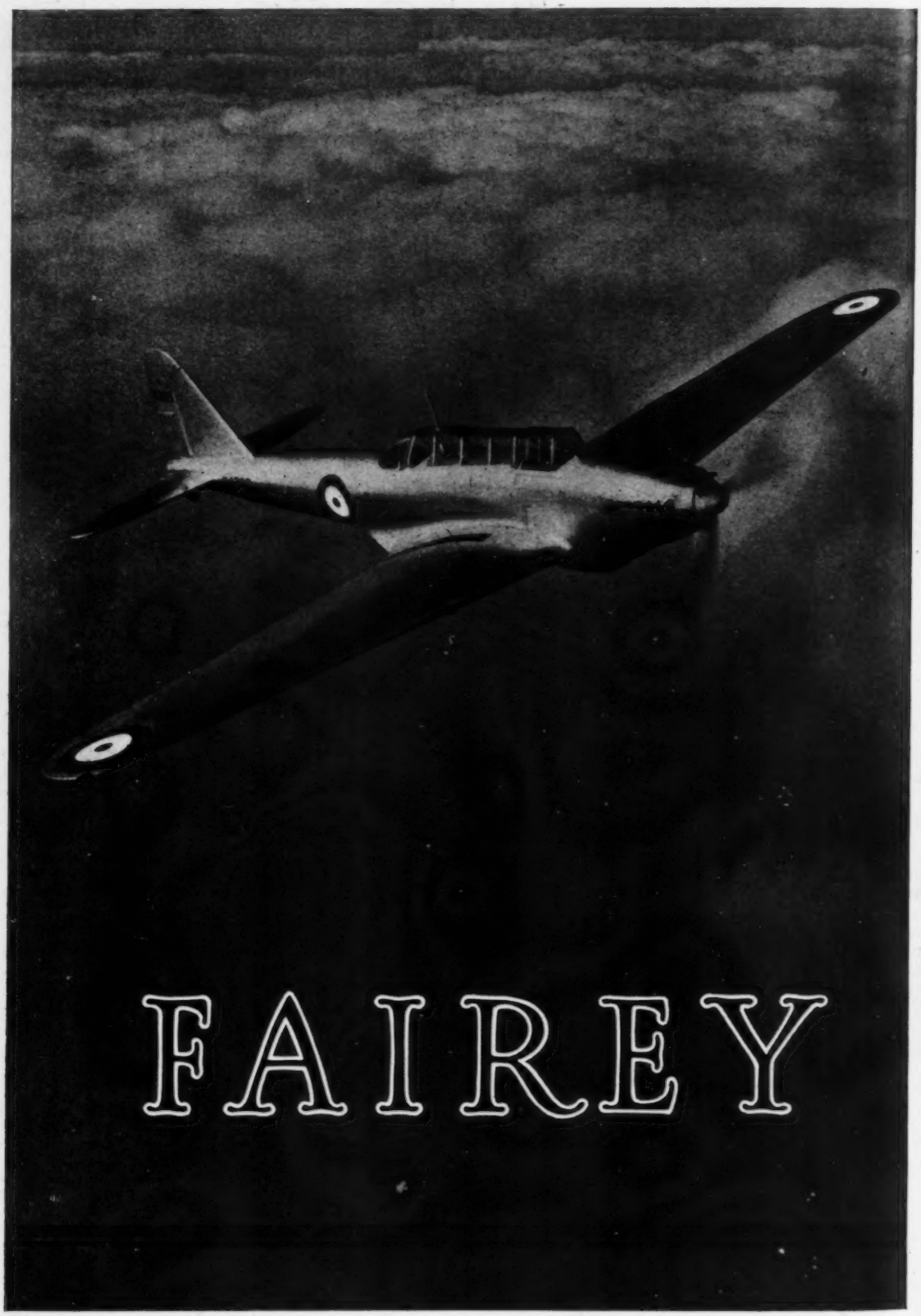
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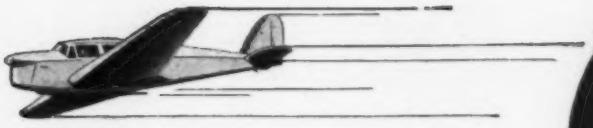

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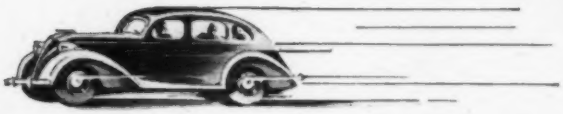

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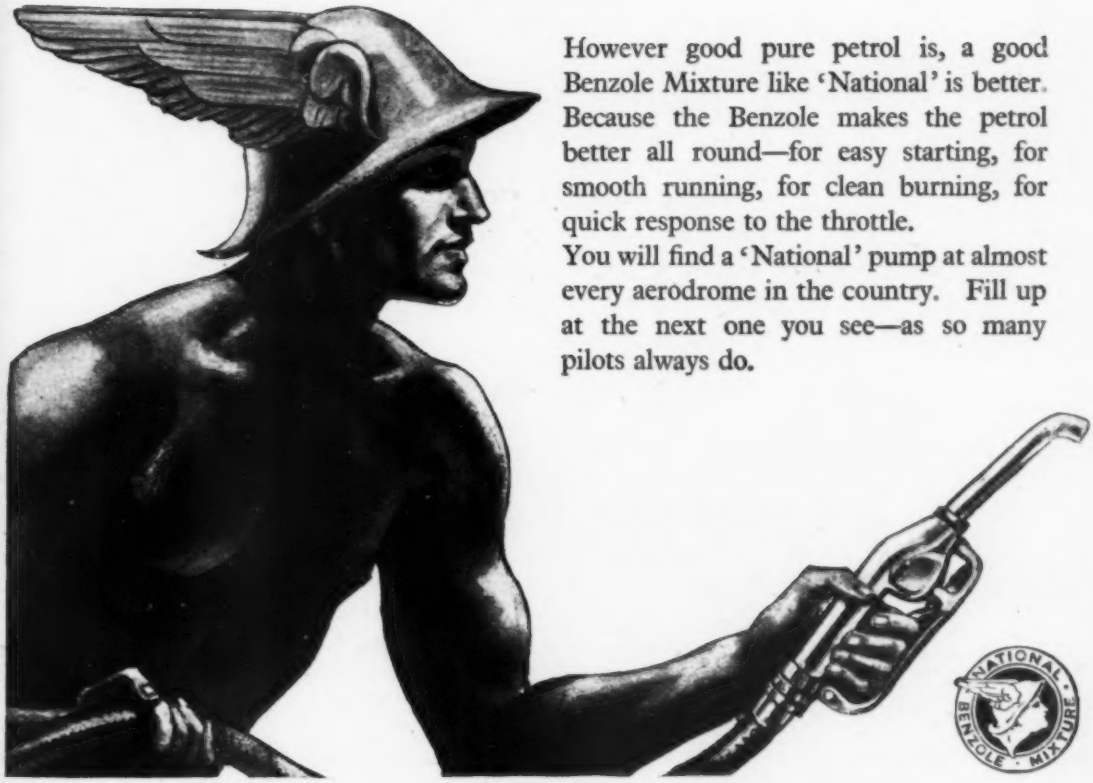

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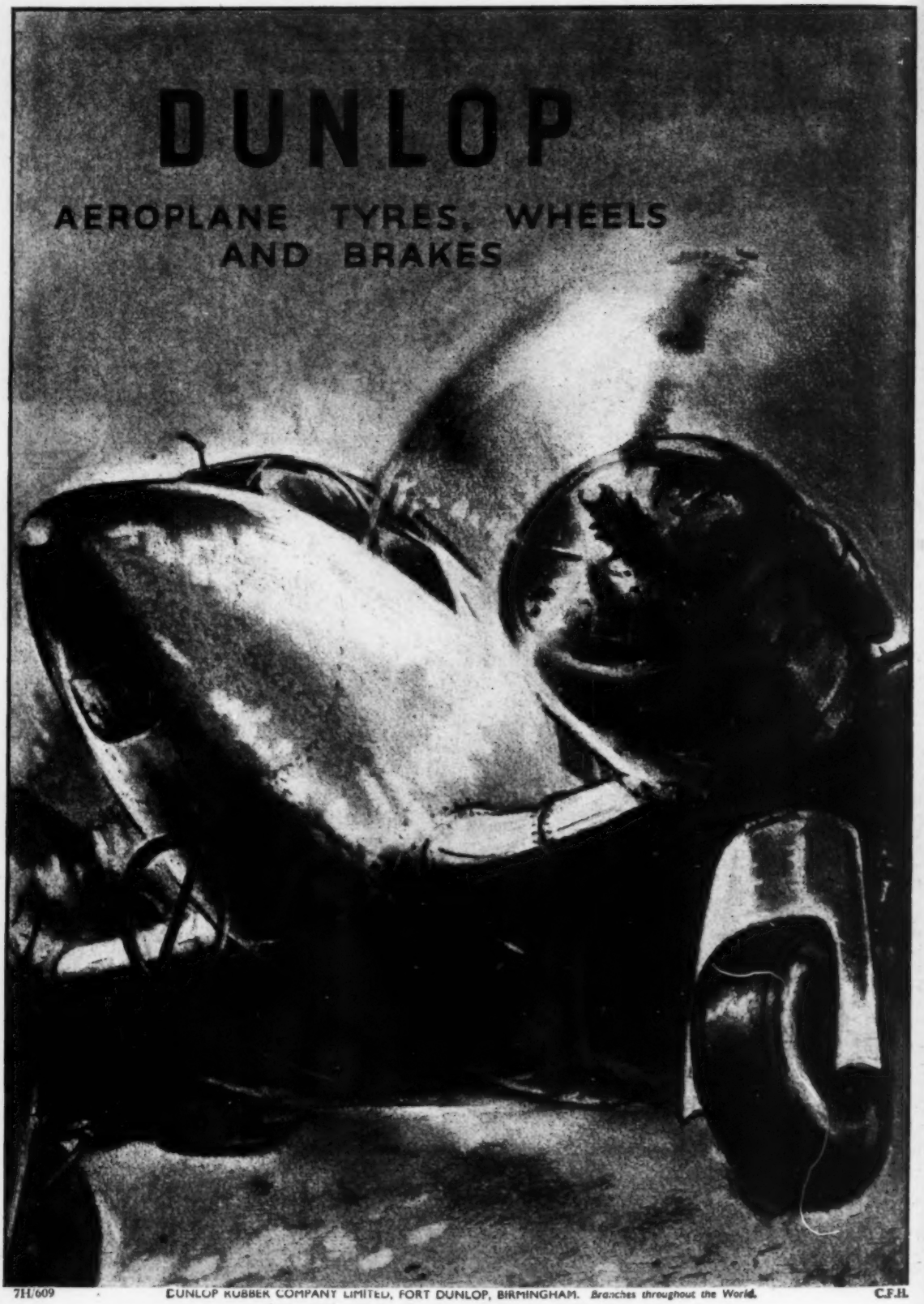

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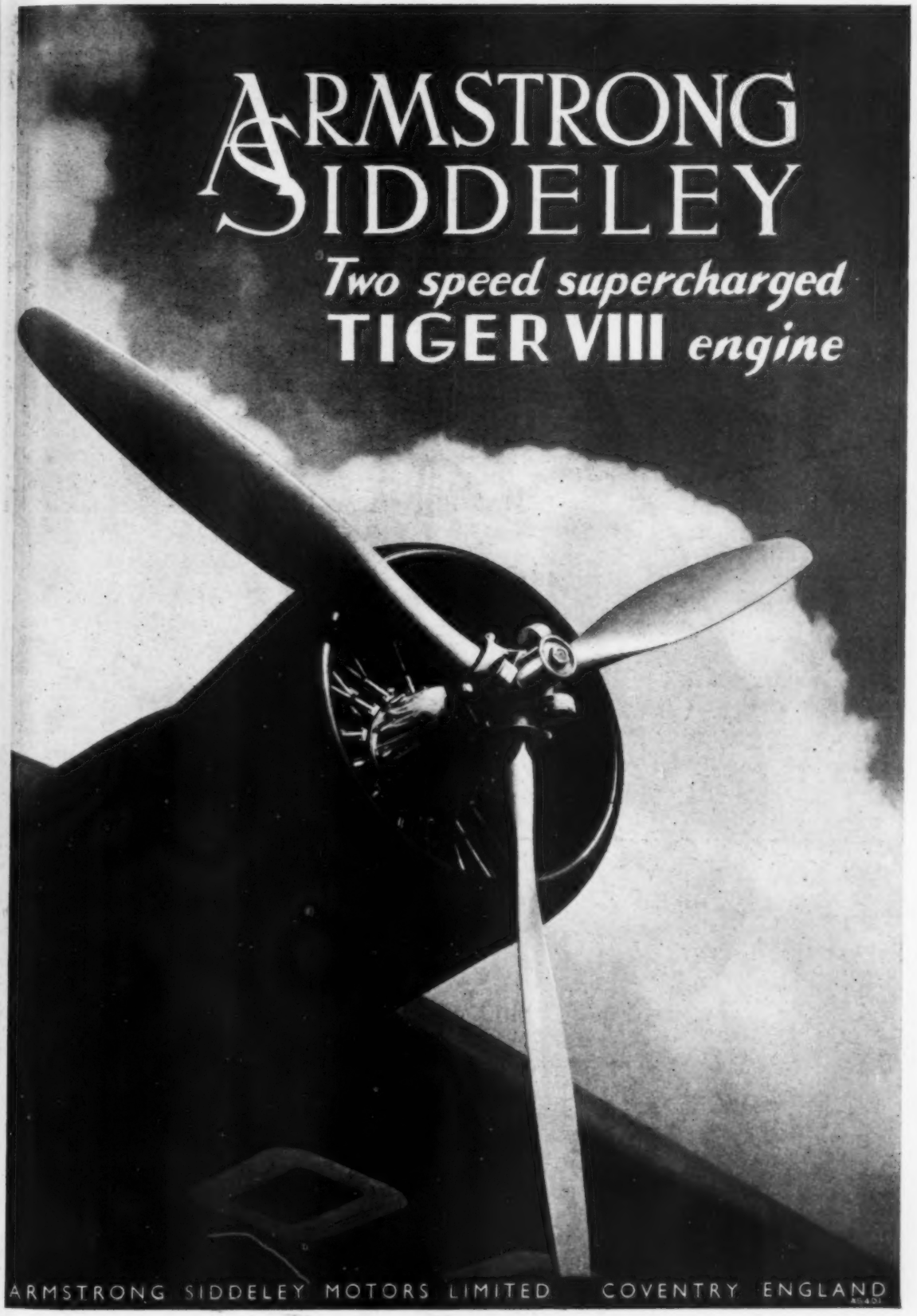
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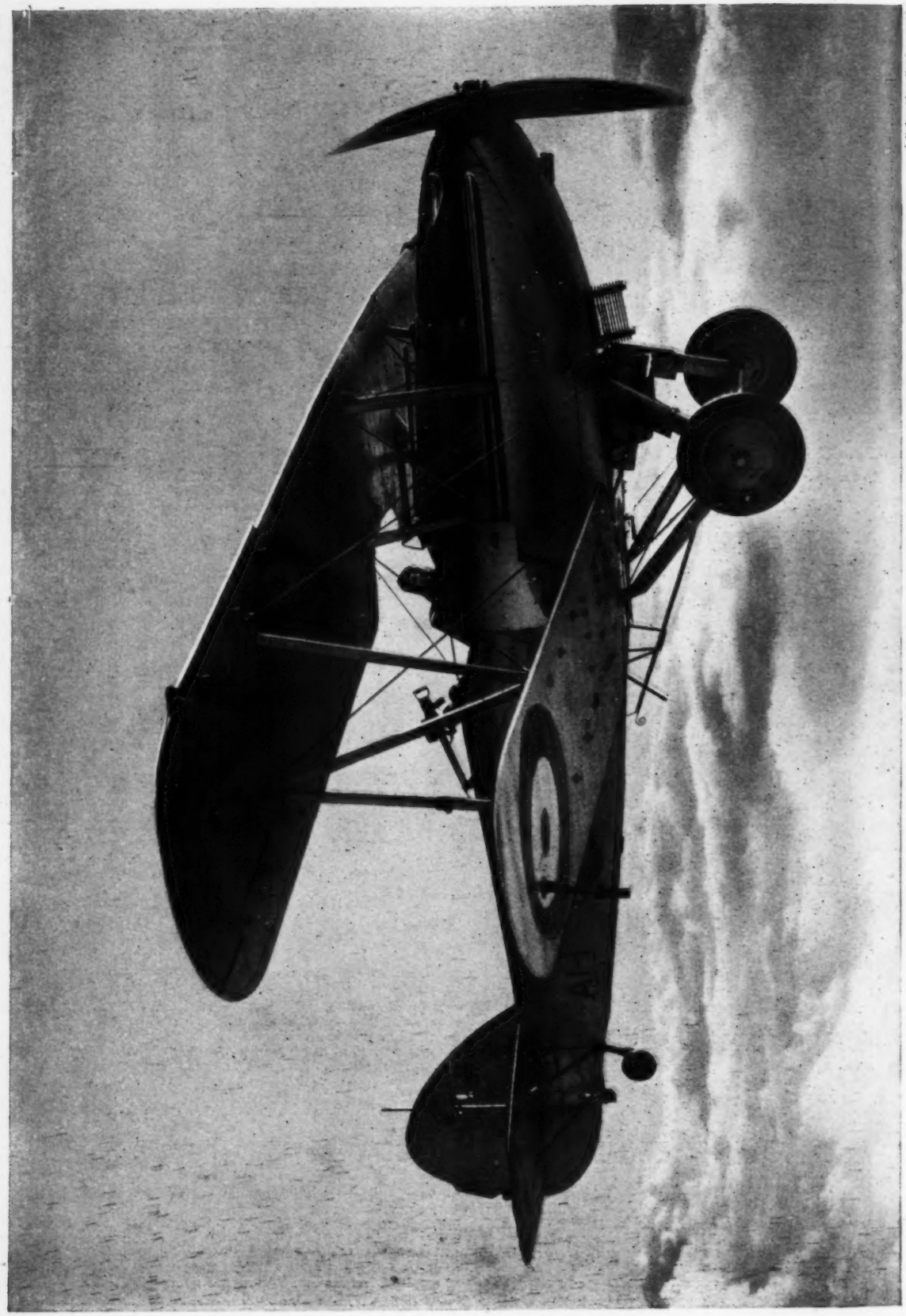

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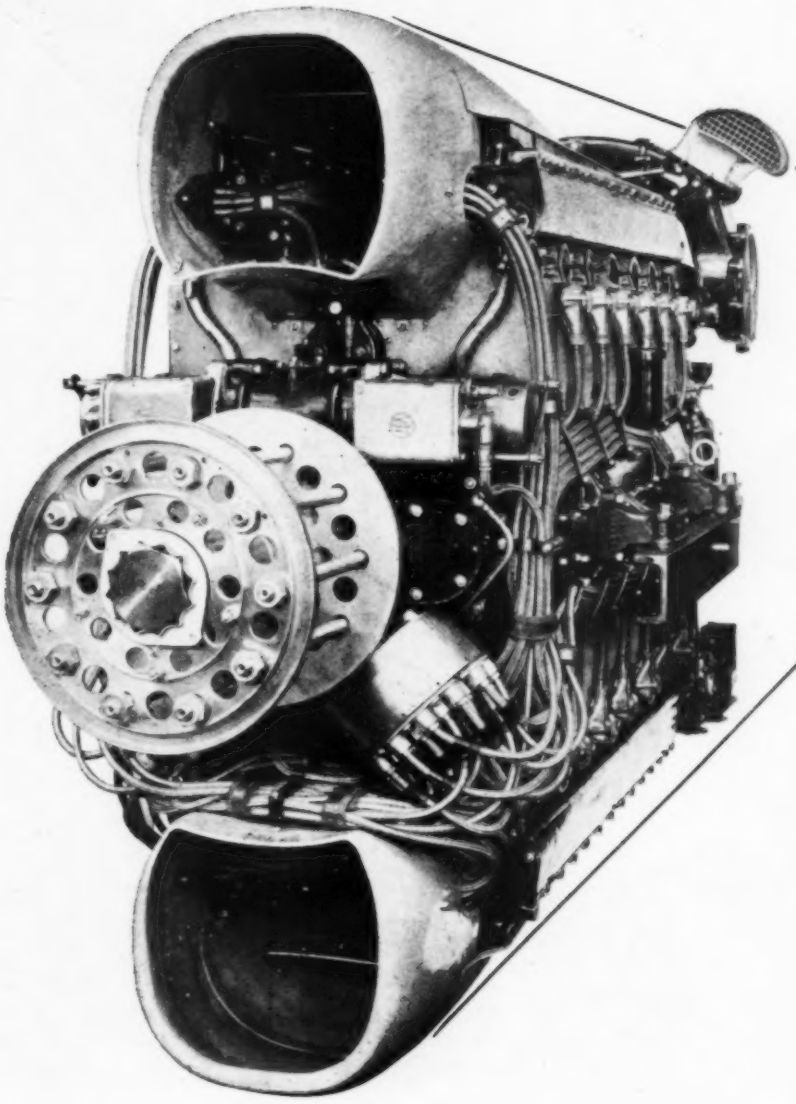

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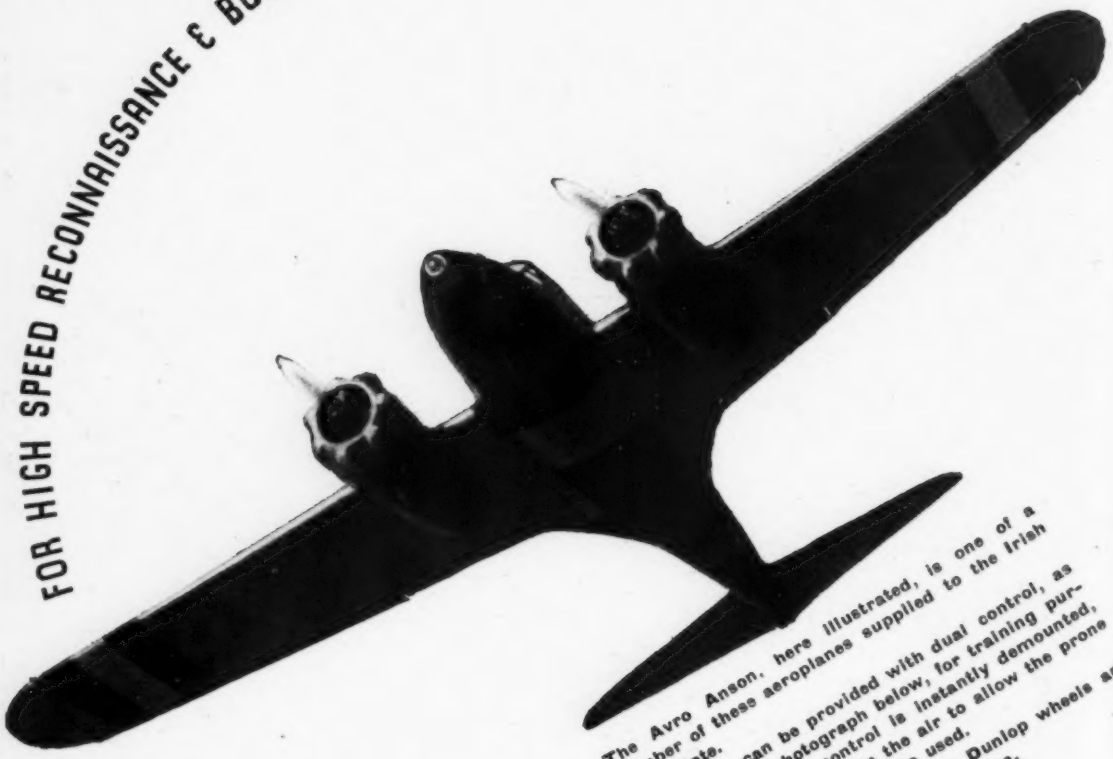

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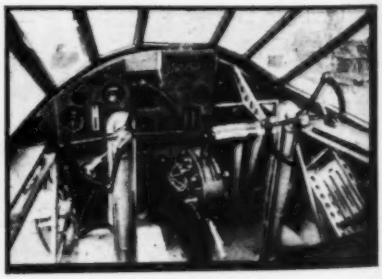

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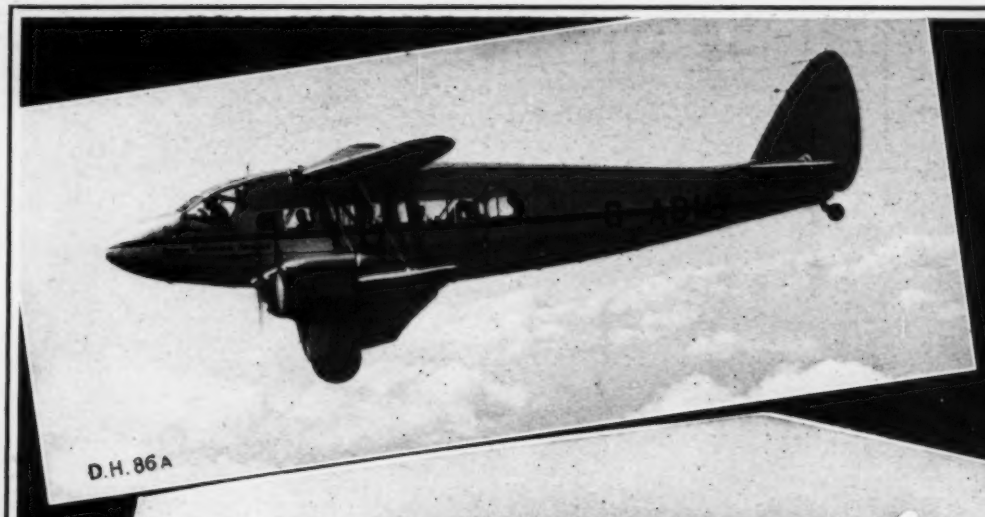
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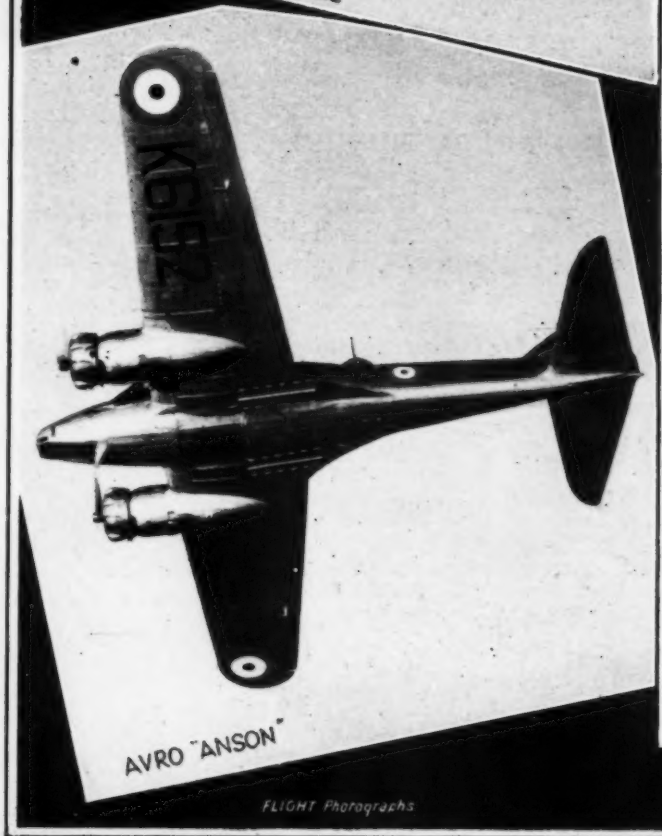
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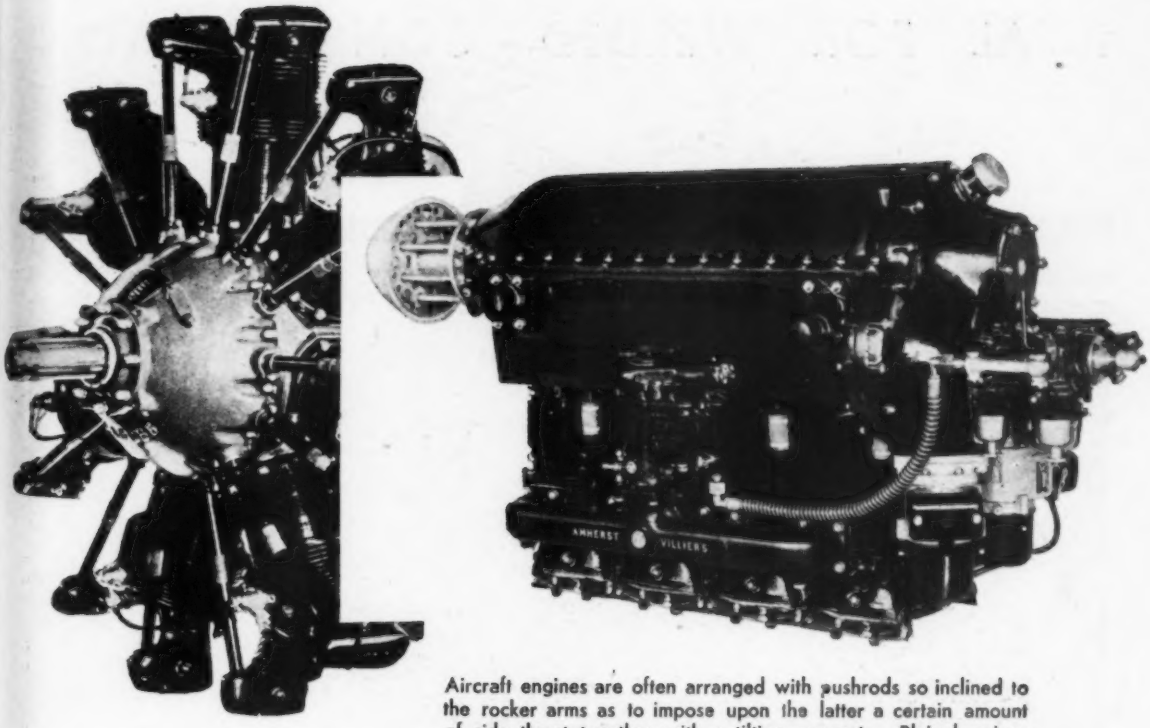

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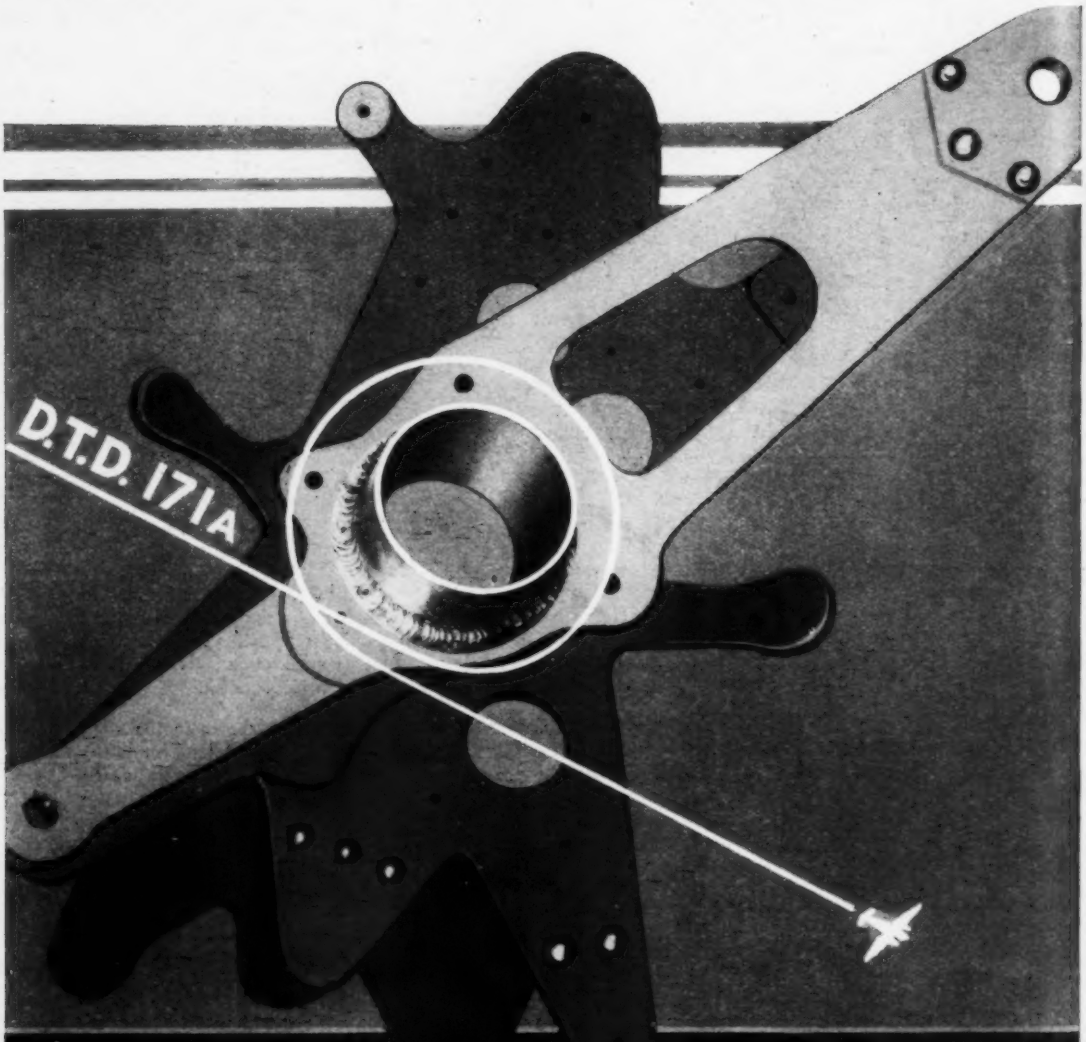

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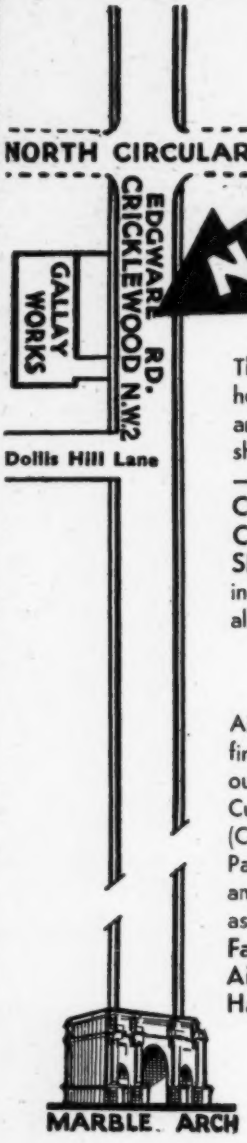

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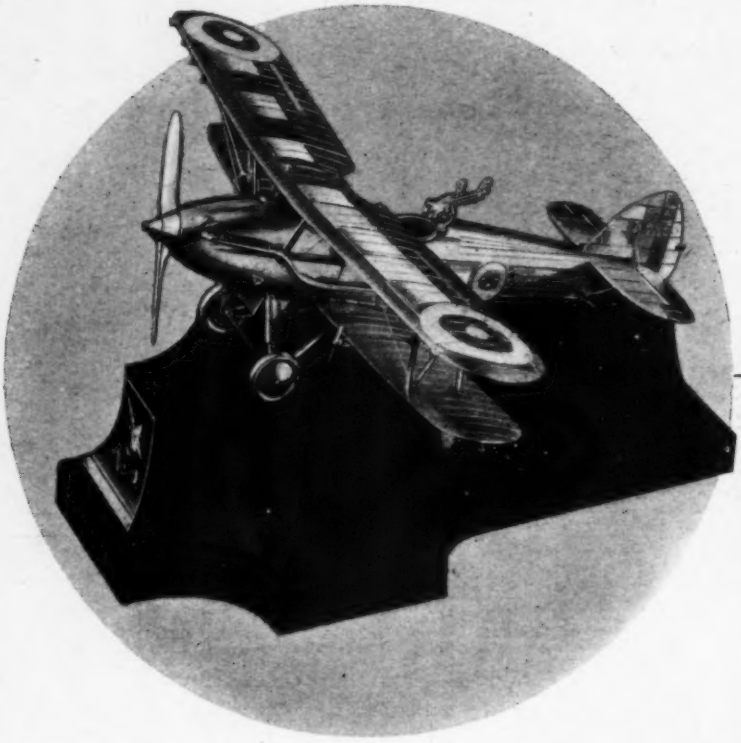

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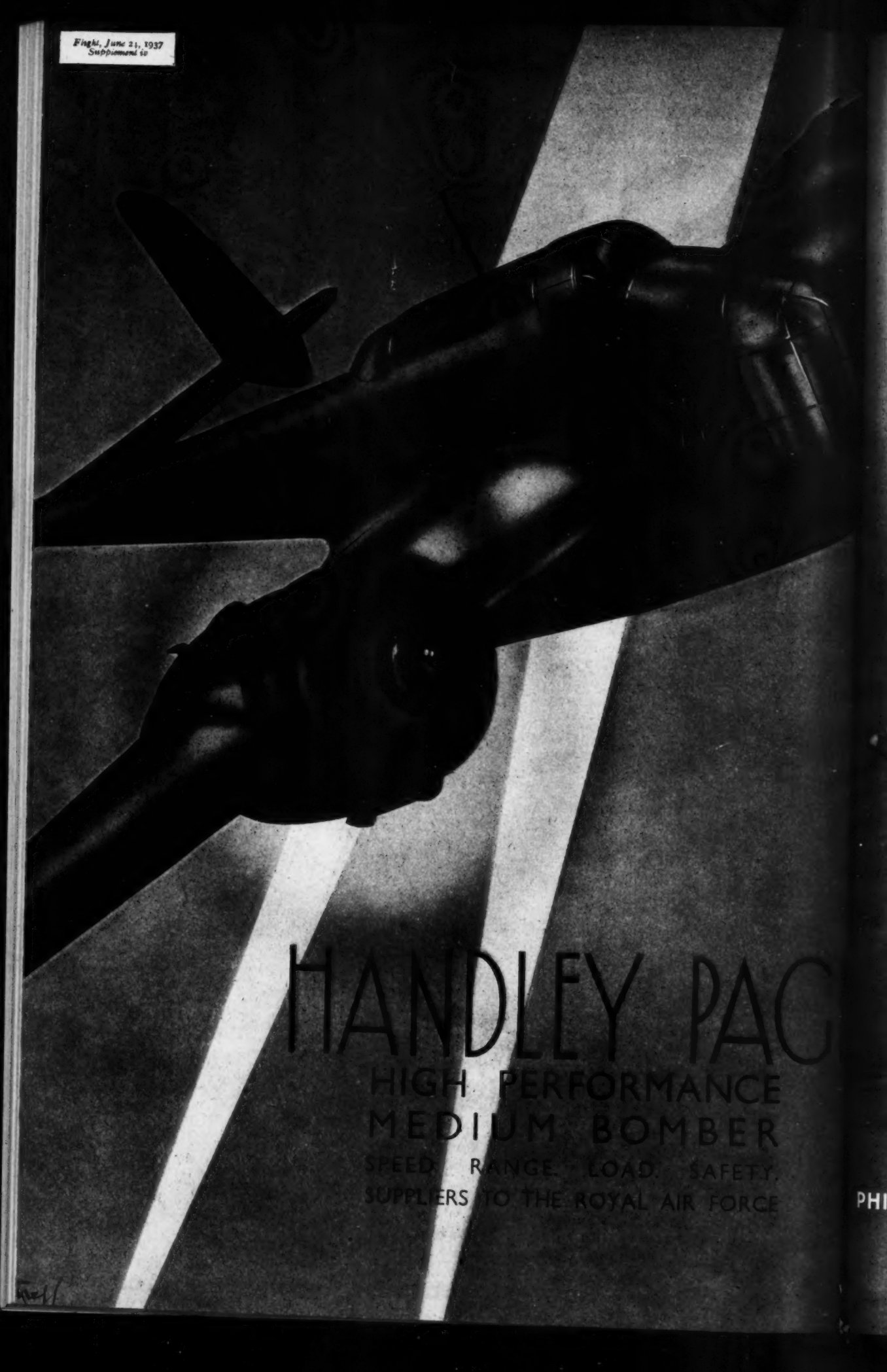

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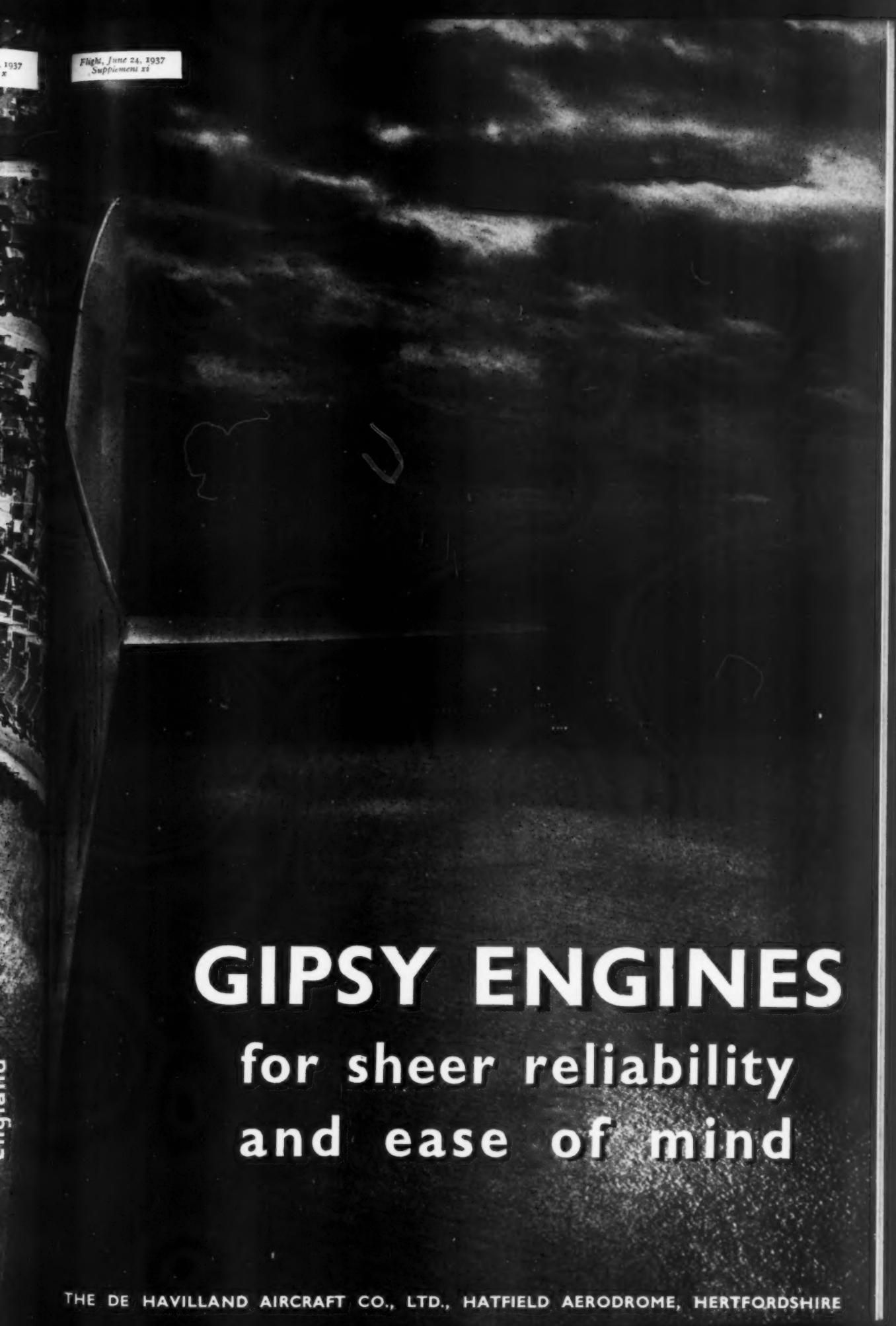
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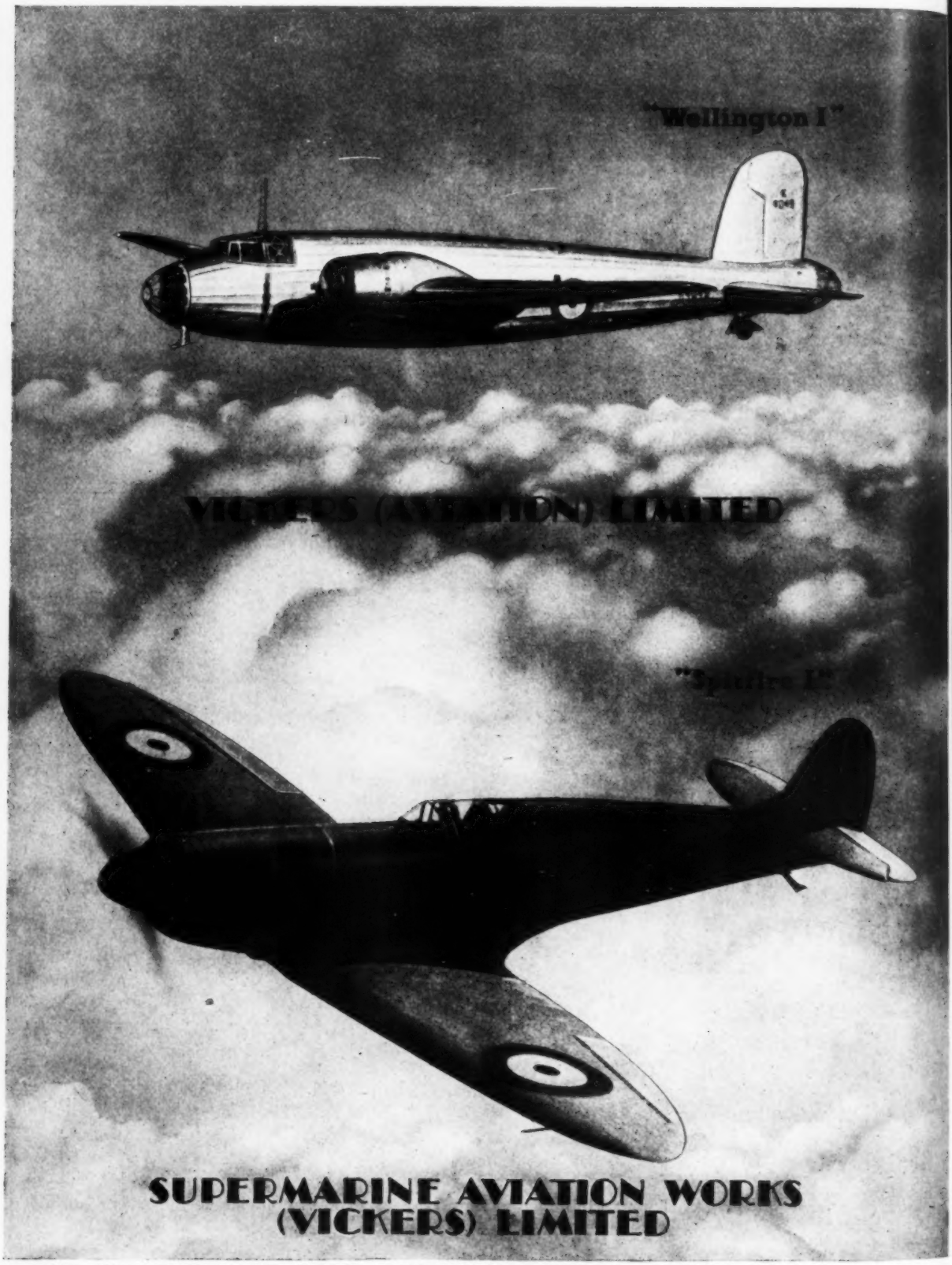

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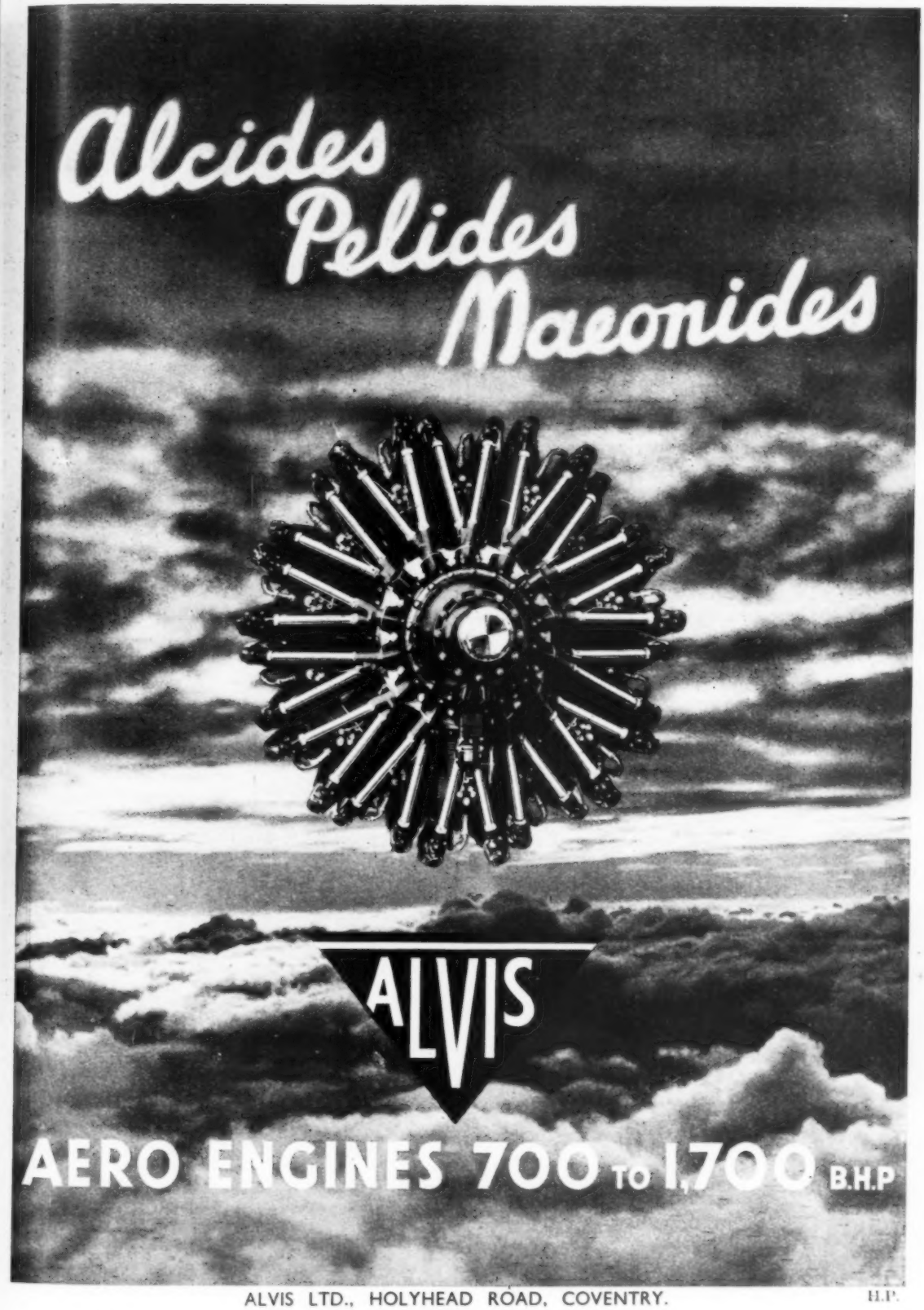

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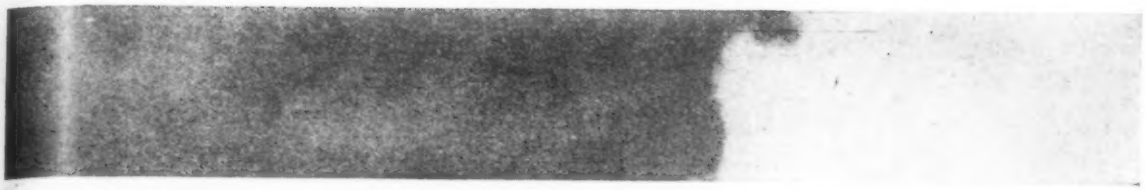

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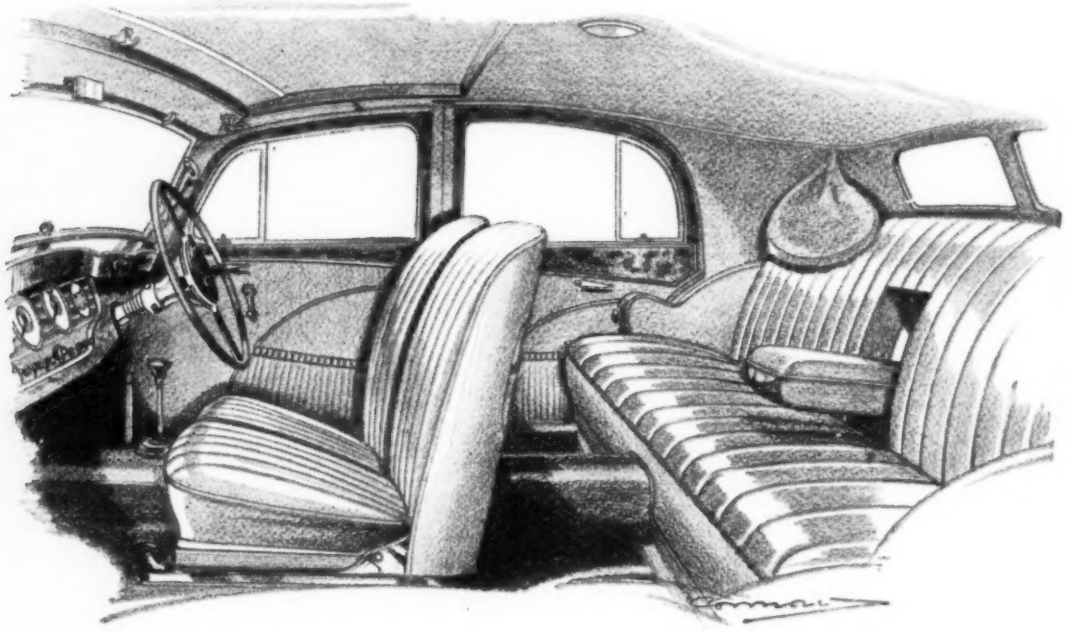

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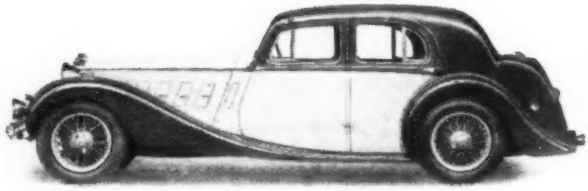

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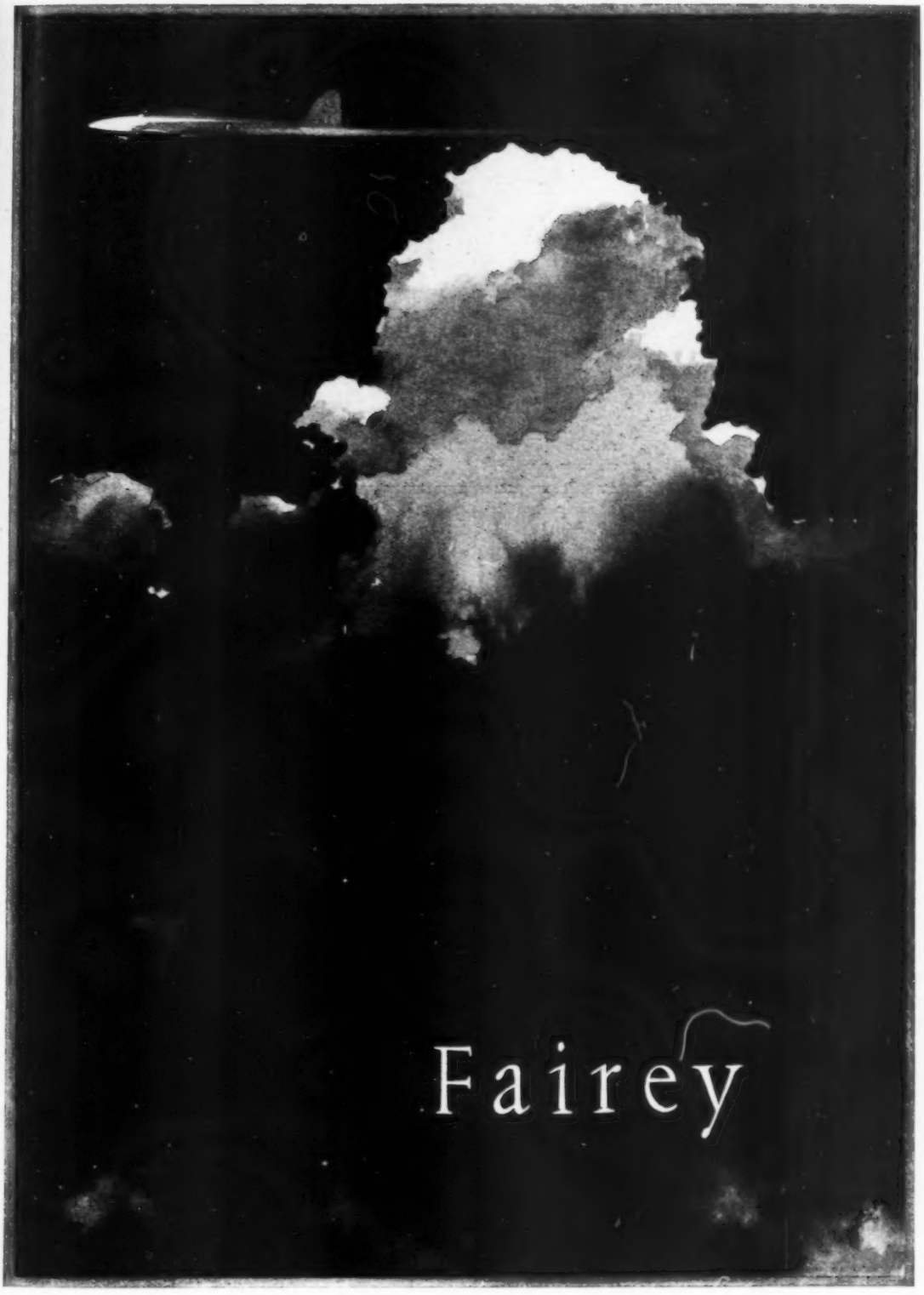

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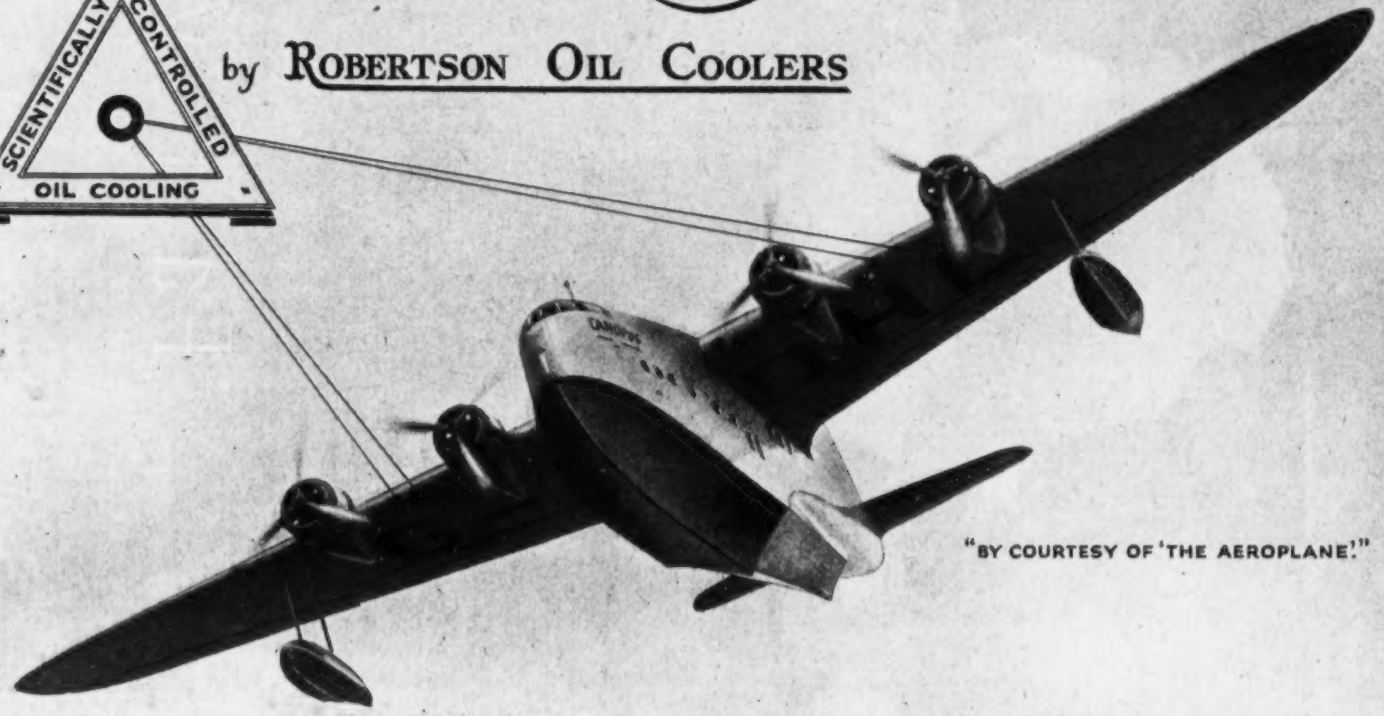

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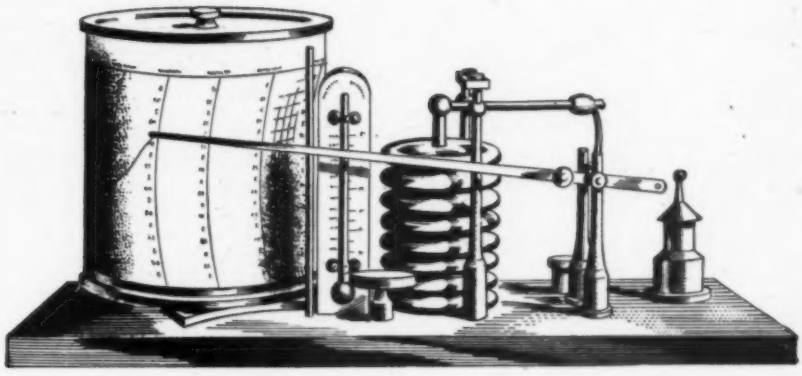

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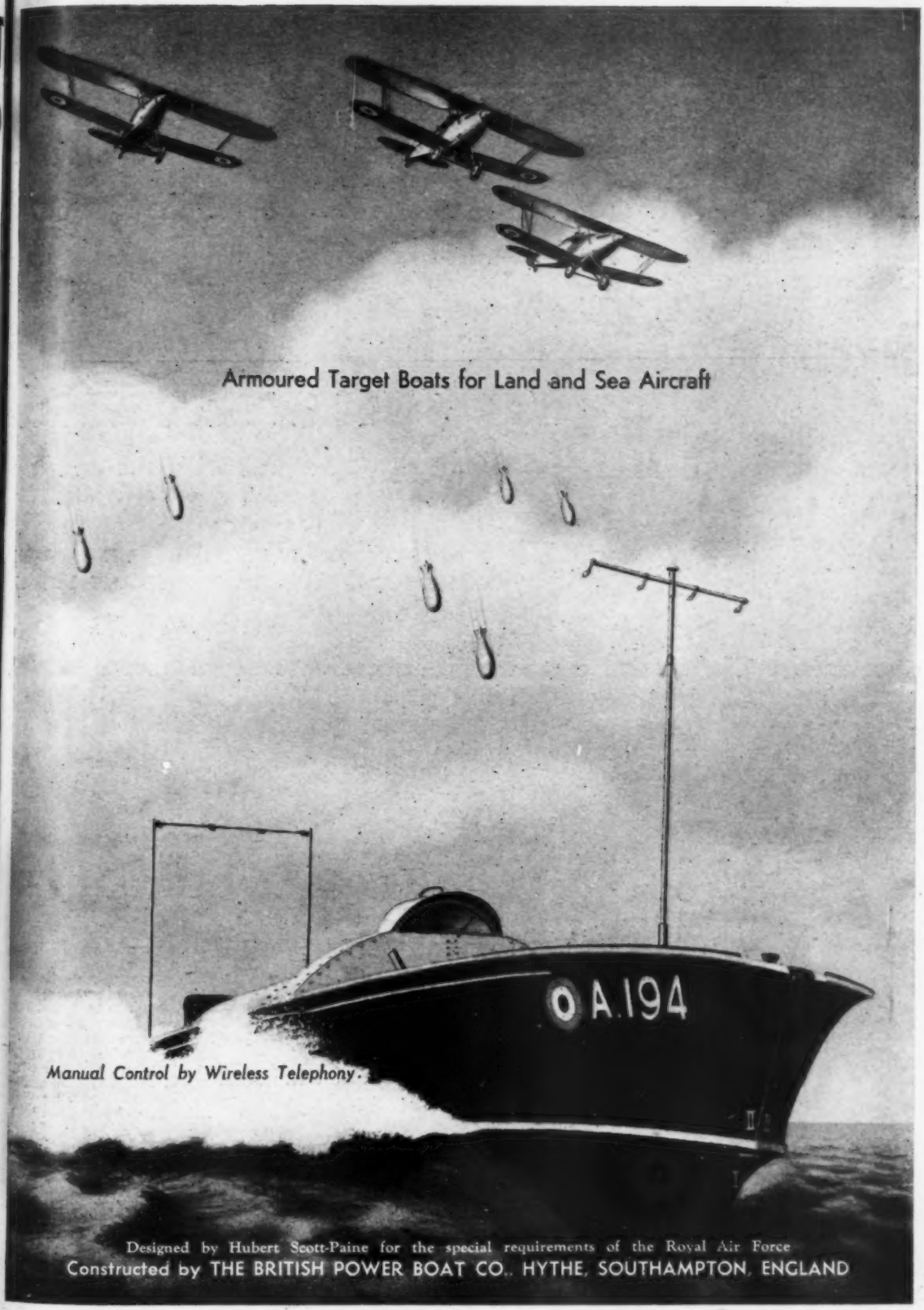
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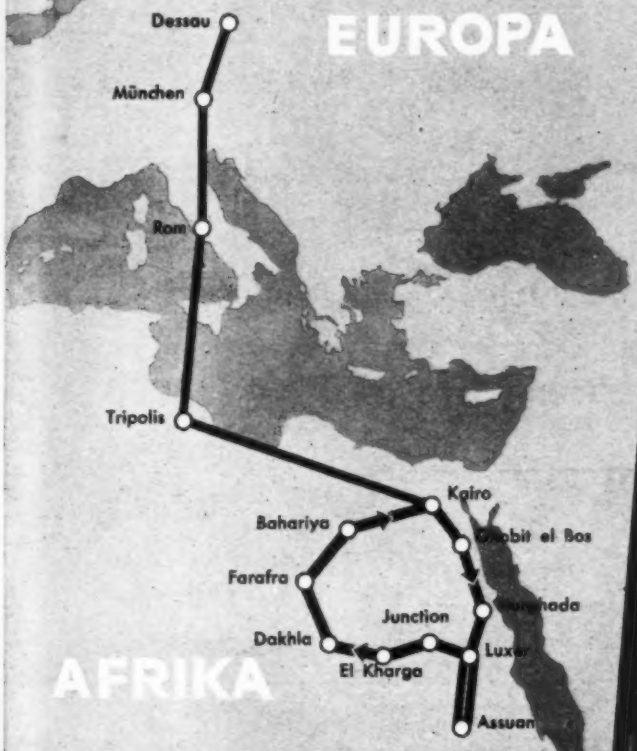

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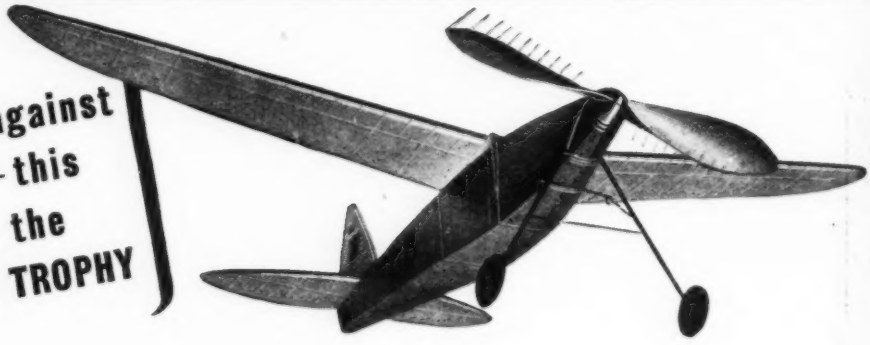

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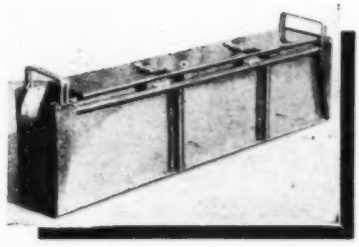

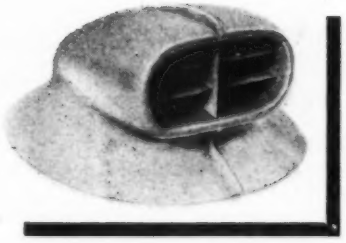

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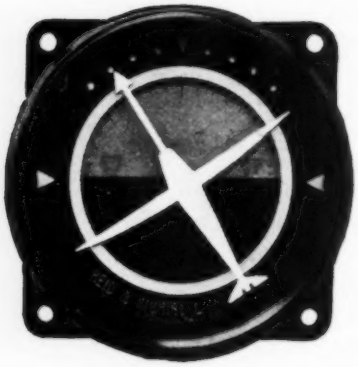

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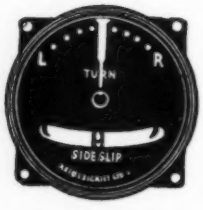

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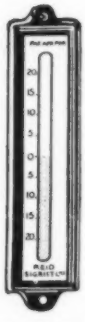

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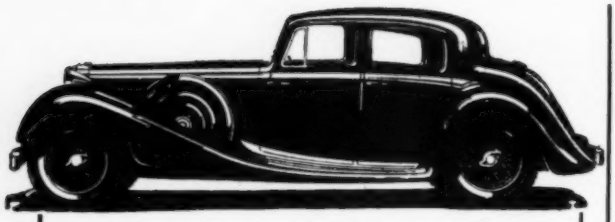

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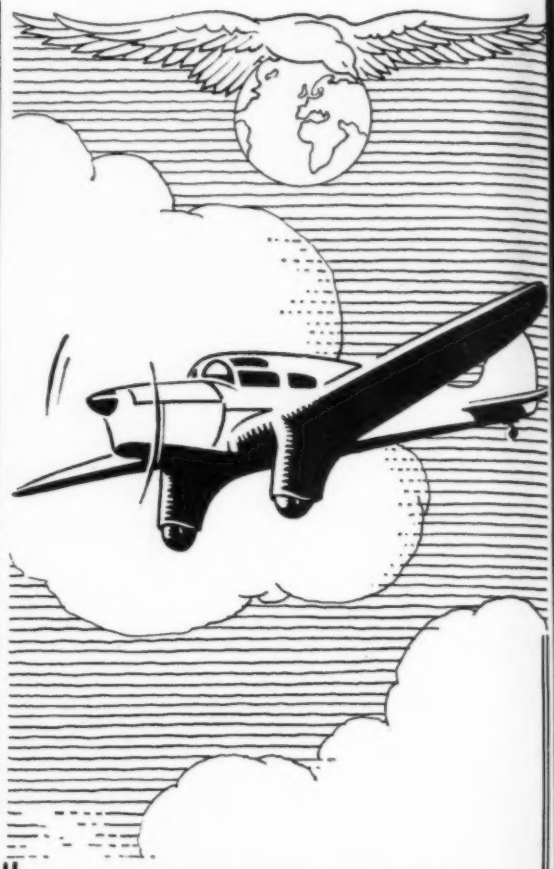

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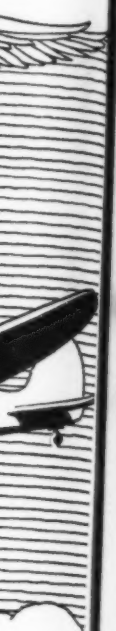

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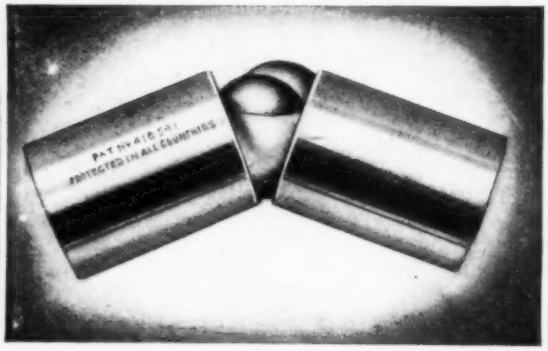

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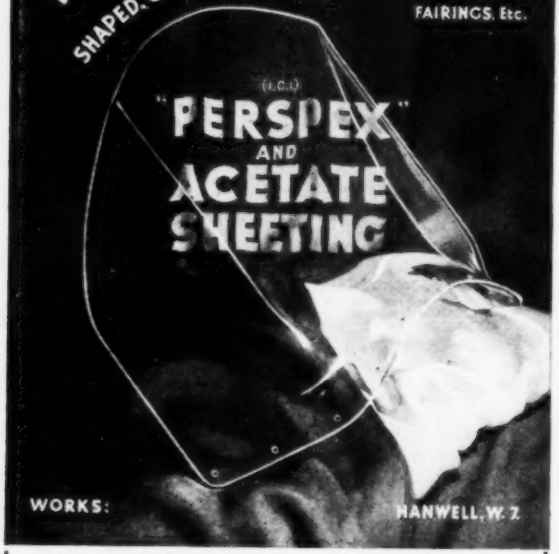

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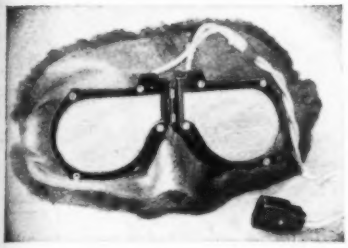

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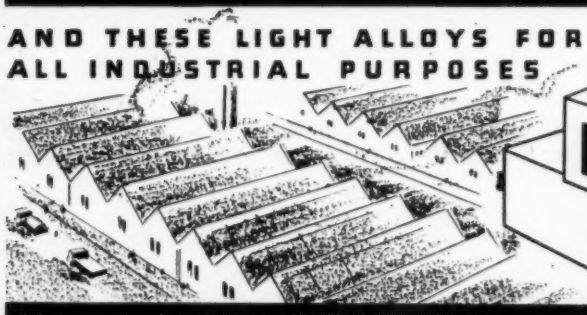

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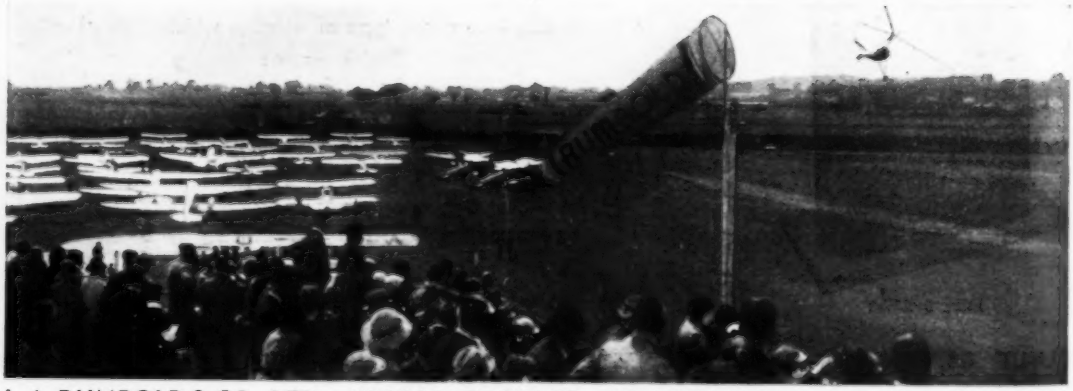

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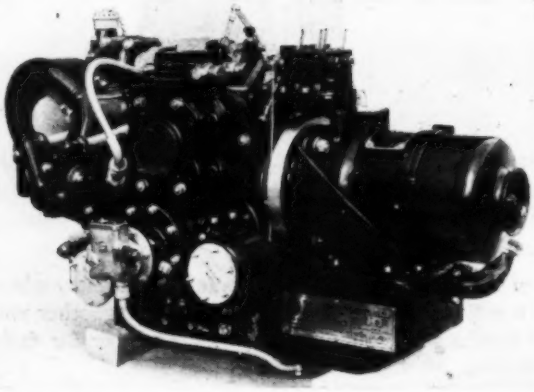

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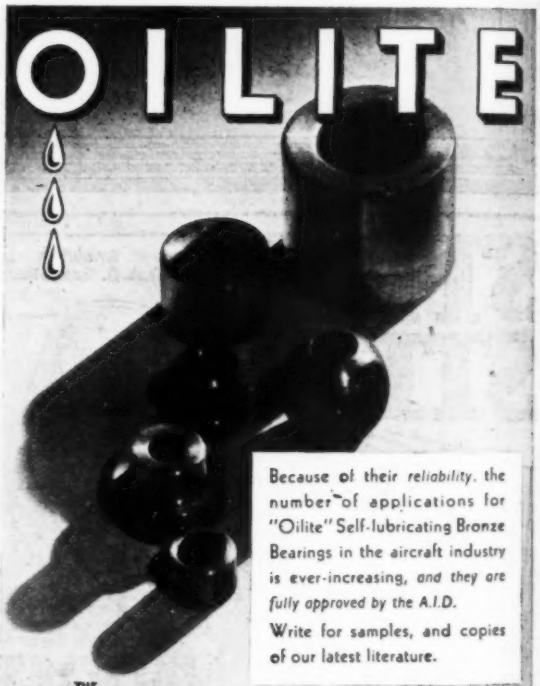

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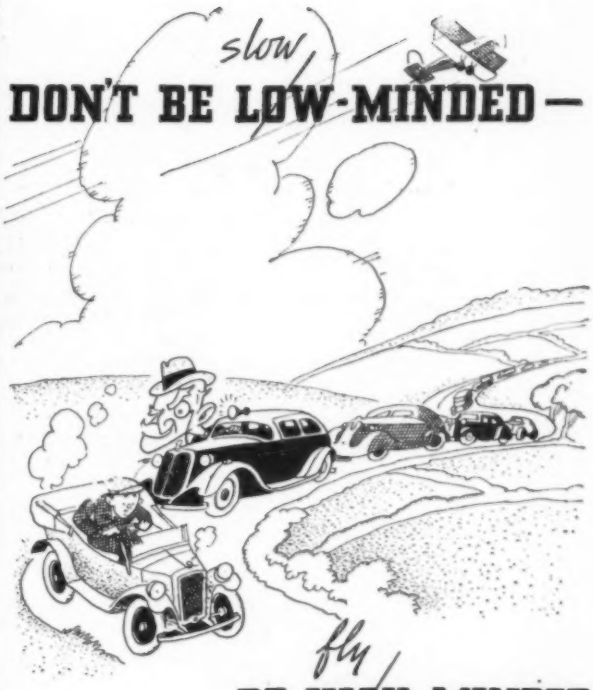

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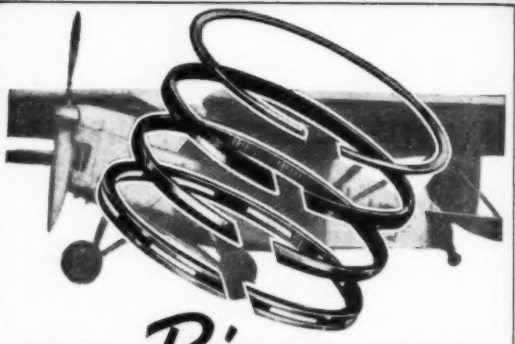

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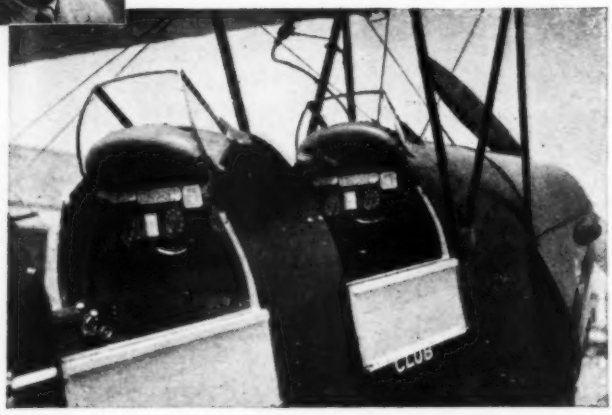

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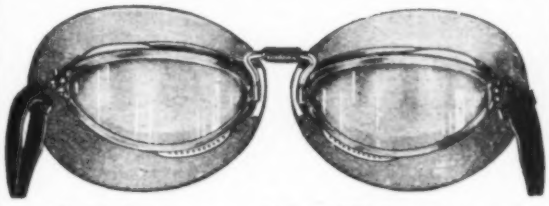

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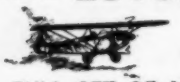
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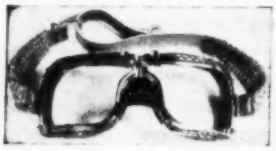
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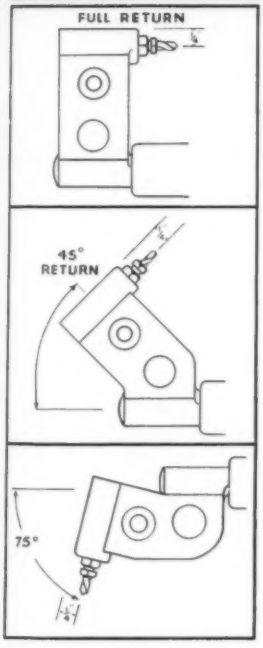

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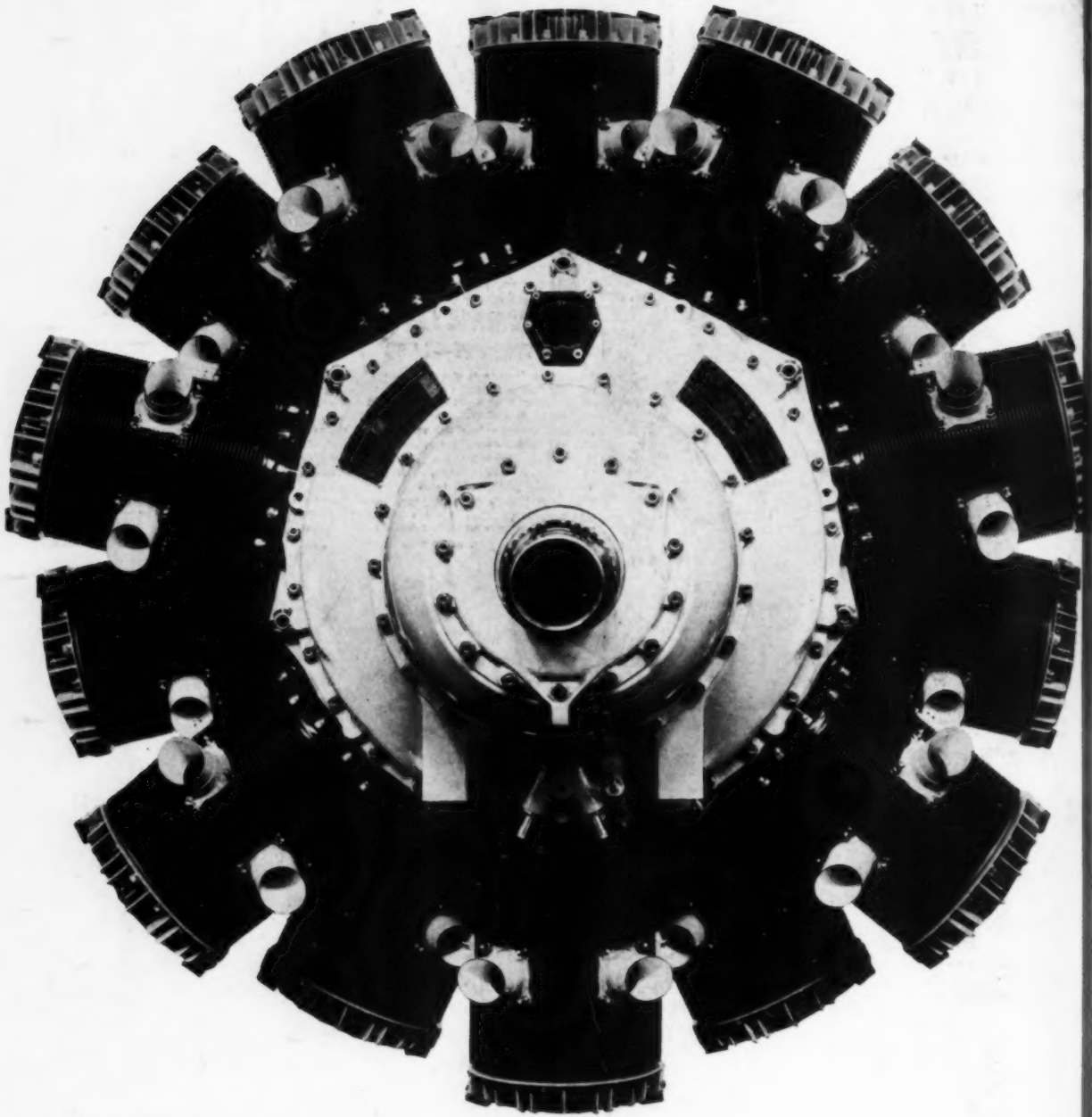

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